MODERN Machine Shop

HOWARD CAMPBELL, Editor

Volume 6 APRIL, 1934 Number 11

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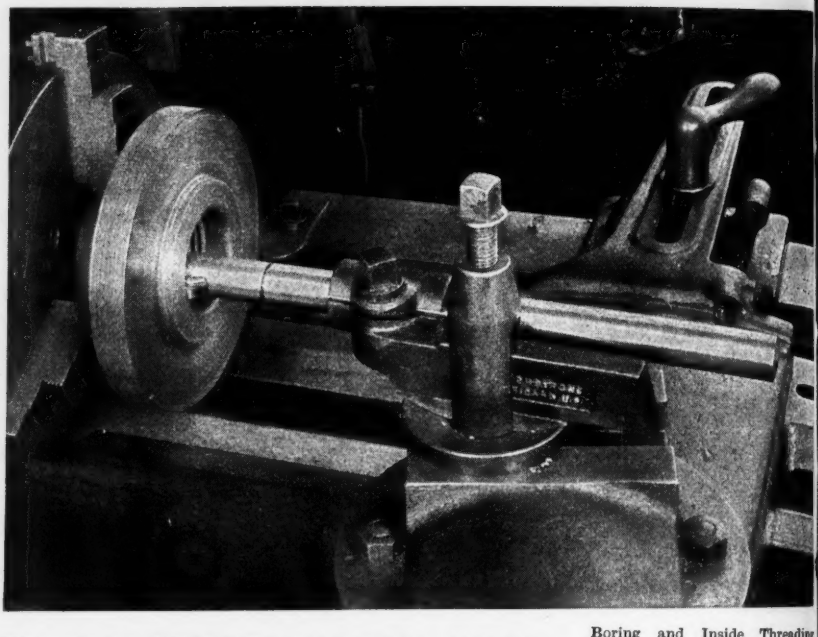

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CINCINNATI, OHIO VOL. 6, No. 11

APRIL, 1934

Motion and Process Economy

In this, the concluding section of the article, the author continues the discussion of the Laws of Motion Economy and closes with a number of examples of cases in which the application of these laws increased production and reduced costs.

BY MYRON A. LEE

Professor of Industrial Engineering, Cornell University

LAW 7. Continuous curved motions are preferable to motions in straight lines where the latter require sudden and sharp changes in direction. A good illustration of this law may be found in a comparison of the operation of swinging a sledge hammer with that of swinging a pickaxe. In swinging a sledge the workman usually has plenty of room and takes a complete circular swing. Before circuses were mechanized as they are today, six or eight circus hands driving a tent stake gave a perfect example of this law as well as of rhythm and timing. In using a pickaxe, the worker is restricted in his movements by the sides of the ditch. He raises the pick to a point somewhat above his head, stops it, and reverses the motion—a very awkward and tiring procedure.

An apt illustration of the result of applying this law is an improvement that was made in the operation of candy dipping. (Farmer, E., "Time and Motion Study," Industrial Fatigue Research Board, Report No. 14, pages 36-41.)

Referring to Fig. 6, the procedure was as follows: A "center" (an almond, walnut, Brazil nut, or caramel) was placed in a pot containing melted sugar by using the left hand, and covered with the melted sugar by working it with a fork held in the right hand. The finished piece of candy was then placed on the tray to the right of the operator with the right hand. Approximately two seconds were required to dip each piece.

Although the lines in Fig. 6 do not show the exact movements of the right hand, yet they give a picture of the main motions used. While the left hand was placing a center in the container of melted sugar, the right hand carried the empty fork from the tray A to the container B, took up some of the thick melted sugar, and pulled it over the center at X. When the hand reached C it moved to

the left side of the container, the center being carried along with the end of the fork under it. The center was picked up at **D** and carried to the tray, where it was deposited.

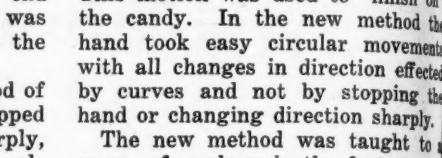
The objections to the old method of dipping were that the hand stopped at **B** and changed direction sharply, and then at **C** the direction was almost reversed. This stopping and sudden changing of direction placed unnecessary strain on the muscles of the arm. The new method is shown diagrammatically in Fig. 7.

Here the hand, after having disposed of the finished piece of candy on the tray, moved from **A** to **B** as before, but reached **B** on the surface of the melted sugar in the middle of an inward and downward curve with the hand in its strongest position for doing work. This made it possible to utilize the momentum developed in the movement **A-B** in doing the most fatiguing part of the work, the dipping being the part of the process that offered the greatest resistance to the hand.

In the old process this dipping motion was made by a short backward movement just after the hand had stopped and changed its direction. Furthermore, the momentum developed during the motion **A-B** was wasted in the old method since the hand motion was checked at **B** in order to change its direction, the muscles of the hand and arm being used to stop the motion instead of doing useful work.

By using the downward motion of the hand in the new method, the melted sugar was swept over the center, and going under the surface in the second part of the curve, it came up at **C**. The piece of candy was then deposited on the tray using a circular motion in the same direction. This motion was used to "finish off" the candy. In the new method the hand took easy circular movements with all changes in direction effected by curves and not by stopping the hand or changing direction sharply.

The new method was taught to a group of workers in the factory with



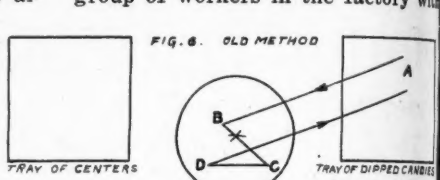


Fig. 6 and 7—Diagrams illustrating the movement of the hand during an unsystematic, "jerky" movement and during a planned, symmetrical movement.

the result that, after a short period of training, an average increase in production of 27.1 per cent was obtained. However, since many workers had used the old method for years it was difficult to persuade some of them to give the new method a fair trial. As a new dipping room equipped with new style tables and trays was being started, new operators were trained in the proper method of dipping. After three months' work in this new room these new workers were producing an average of 88 per cent more than the workers of the same standing in the original room.

Laws 8, 9 and 10 are to quite an extent self-evident except that there is a considerable amount of discussion as to just what constitutes rhythm. Such a discussion would, however, be

beyond the scope of this article.

Law 11. The hands should be relieved of all work which can be performed more advantageously by the feet or other parts of the body. Most electric sewing machines are arranged to be operated by the use of a foot pedal switch or a switch operated by a knee lever. The driver of an auto would be rather busy if the controls were arranged as they are on many machine tools.

Law 12. Drop deliveries should be used wherever possible. The ideal arrangement is, of course, to have the part fall into a delivery chute of its own accord at the end of the operation. At the General Electric Company in Schenectady, a countersinking operation was arranged with the drill spindle operated by a foot lever. The operator placed the part on a suitable rest and brought the countersinking tool down. When the tool was released the weight of the part overhanging the rest caused the part to topple into a drop delivery chute while the operator was obtaining the next piece.

Law 13. Gravity feed containers and bins should be used, arranged to deliver the materials as close to the point of use as possible. This results in several economies. It may bring the necessary motions into a lower classification, saving time and reducing fatigue. The parts are always in a fixed position, thus reducing the time required to grasp them and usually improving the rhythm of the operation.

The General Electric Company applies this principle to their small assembly work and to the location of parts used on punch presses. The Westinghouse Company and Link Belt Company have also applied this principle in rearranging punch press and drilling operations.

Law 14. Tools and materials should be located around the work place and as close to the point of assembly or use as possible. This frequently results in the placing of materials in bins located in a semi-circle about the work place and sloping towards the worker. These bins form a sort of amphi-theater effect about the work place and are very convenient.

Law 15. Definite and fixed stations should be provided for all materials; tools and light equipment should be prepositioned wherever possible. If motions are to be smooth and become to a certain extent automatic, each tool and part must be located in the same position each time it is used. For this reason a fixed place for each tool should be determined and the cycle of motions so arranged that when the tool is used it is returned to this fixed position ready for the next cycle.

Law 16. Mechanical devices should eliminate the therblig "hold" whenever practicable. In the cap screw and washer assembly the left hand originally spent much of the time merely holding the cap screw. In the improved assembly this was entirely eliminated. The outstanding violation of this law is in the operation of gauging parts. The usual method is to hold the gauge in one hand continually and use the other hand for the parts to be gauged. The Cadillac Company, American Hard Rubber Company, and others, have devised fixtures to hold gauges, leaving both hands free to handle the parts. By this method a saving of about 40 per cent in the time required for the operation usually results.

Laws 17 and 18. Either sitting or standing for long periods of time produces more fatigue than alternately sitting and standing. Since operators vary in height, it requires some adjustment to locate the workplace at the right height so that the operator

may work standing with forearms approximately level, which is the desired condition. Scientifically constructed chairs that can be adjusted for height are available. While meeting these requirements may cause some trouble and expense, carefully

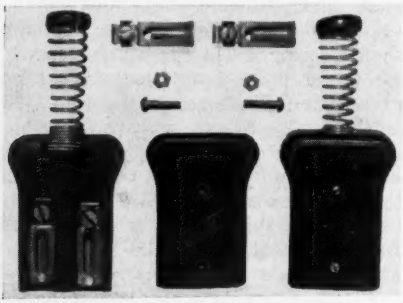


Fig. 8—Parts of a "plug" for an electric iron, for which the assembling bench shown in Fig. 9 was made.

conducted tests have demonstrated that this trouble and expense are justified by the improved health and productivity of the operators. This is particularly true in the case of women operators.

Laws 19 to 21 need no further comment.

Law 22. It is usually quicker to transport small objects by sliding than by carrying. Watch the cashier in a bank counting change. One of the improvements in the cap screw and washer assembly permitted the transporting of the washers by sliding.

Law 23. A "full hook" grasp is usually quicker than a "pressure" grasp. It is much easier to pick up a pencil lying with one end raised than when it is lying flat on the desk. Frequently a container may be arranged to deliver small parts so that the operator in grasping the part, may hook the fingers under the part instead of depending upon pressure of the fingers to grasp the part.

Law 24. This law is, of course, of interest mainly to time study men engaged in micro-motion study and analysis. At the General Electric Company an assembly requiring 44 parts was arranged on the basis of previous studies made of other assemblies. The time which should be required was ascertained from established standards for the therbligs involved and later the operator's actual time on the assembly did not vary more than five per cent from the time set.

Law 25 can also be applied only as the result of micro-motion analysis.

In the laboratory at Sibley School of Mechanical Engineering (Cornell University), several good examples of the application of these laws have been developed. One problem undertaken was the assembly of an electric plug such as is used on an electric iron, shown in Fig. 8. The fixture and work place shown in Fig. 9 was set up. The parts were first assembled without a fixture of any kind and it

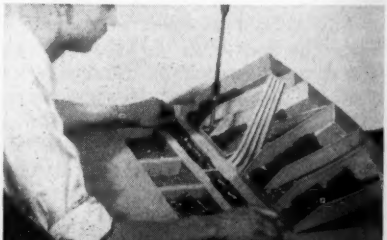


Fig. 9—The nuts slide down chutes and are pushed into place by plungers operated by a foot pedal. Assembling time was reduced by 50 per cent.

was ascertained that positioning the nuts and holding them in their recesses consumed most of the time.

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In the fixture shown in Fig. 9 the nuts slide down chutes directly beneath the recesses and are pushed up into place by plungers operated by a foot pedal. Parts are located in convenient positions, two plugs are assembled at one time, both hands performing identical operations until the operation of tightening the screws. This is done with a push screw driver, shown hanging in the corner of the illustration, which is, of course, operated in the usual way. With this fixture a plug can be assembled in less than 50 per cent of the time required without a fixture.

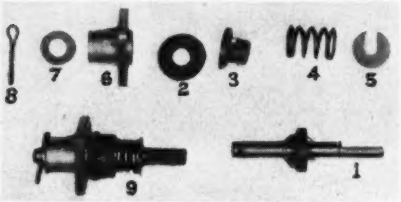

Fig. 10—Parts for a radio control pin.

Another very interesting example is the fixture devised for the assembly of the radio control pin, shown in Fig. 10. The fixture developed for the assembly of these parts is shown in Fig. 11. The part numbers hereafter referred to are shown in Fig. 10. With this fixture each hand assembles a part, the hands each performing the same operations throughout nearly a complete cycle. First each hand places a part No. 1 in a hole in the fixture. Fig. 11 shows these parts in place in the center of the fixture. The hands then place parts Nos. 2, 3 and 4 in succession on the pins. Depressing a foot lever forces the pins against yokes, compressing springs No. 4 and making it possible to slip the horseshoe washers, No. 5, into the grooves on the pins. The springs and washers hold the pins on the yokes while parts Nos. 6, 7 and 8 are placed on the other end of the pins. The final operation, bending the cotter pin, No. 8, is the only case where the hands are not performing identical operations. As soon as the cotter pins are bent, a foot lever is depressed which kicks the pins (now assembled as shown at 9 in Fig. 10) into a drop delivery chute.

While assemblies have been featured in this article to illustrate the application of many of the laws, it is not to be assumed that this is the limit of their field of application.

Various Applications of the Laws

Drilling and Tapping Operations.—Instances have already been cited of improvements in drilling and countersinking. At the Westinghouse Electric and Manufacturing Company an interesting change in a drilling method was developed. In addition to rearranging the location of parts for greater convenience, the drill itself was rebuilt. By means of an air

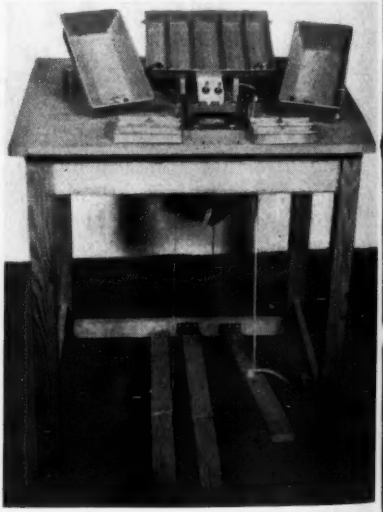

Fig. 11—Assembling bench and fixture for radio control pin.

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cylinder the part and its jig were forced up against the drill, the drill spindle remaining stationary. As the jig was elevated it closed automatically. The job was easier, safer and 25 per cent faster.

Punch Press Operations.—Here is one of the most fertile fields for improvement. The ordinary set-up for a punch press operation frequently requires the operator to make awkward or unnecessary motions and seldom allows for effective use of both hands. At the Link Belt Company, Chicago, a rearrangement of a stamping operation reduced the time per 1,000 parts from three hours 20 minutes to one hour. At the General Electric Company, the application of the laws to a swaging operation resulted in an 82 per cent increase in production. One of the improvements was to change the die to accommodate two assemblies, thus allowing the operator to use both hands effectively.

Forging Operations.—At the Westinghouse Company, a forging operation was studied and the resulting changes made it possible for two men to perform the operation instead of three; the operation was safer and less fatiguing, and 40 per cent faster.

Operating Power Sewing Machine.—Studies at a plant using power machines for sewing short seams on canvas shoes disclosed the fact that the operator spent about one-third of the operating time reaching up to turn the hand wheel of the machine to raise the needle out of the work at the end of the seam. Attaching a device to the machine which caused it to stop automatically with the needle in the raised position resulted in a 23 per cent increase in production.

Plant Layout.—A study of some departments at the Cadillac Motor Car Company resulted in rearrangement of machines with very material savings. In one case it was found possible to reduce the number of operators from 27 to 17, eliminate several machines, reduce the floor space required 40 per cent, and substantially reduce the amount of work in process.

Office Layout.—The Link-Belt Company of Chicago applied the principles of motion economy to the layout of its factory office. The conventional office layout was entirely discarded and desks and equipment arranged with reference to the work done and sequence of routine.

There is apparently no limit to the field of application of these laws. Machine and tool designers should be familiar with them and their application. From the standpoint of motion economy there is a wonderful chance for improvement in equipment.

With manufacturing conditions as they are today, no manufacturer can afford to overlook an opportunity for legitimate and justifiable economies. The improvements resulting from a wise and ingenious application of these laws certainly may be classed as justifiable and legitimate economies, for the work is usually made easier, safer and more healthful for the operator, with a chance for the operator to be benefited by increased wages and the manufacturer by lower costs.

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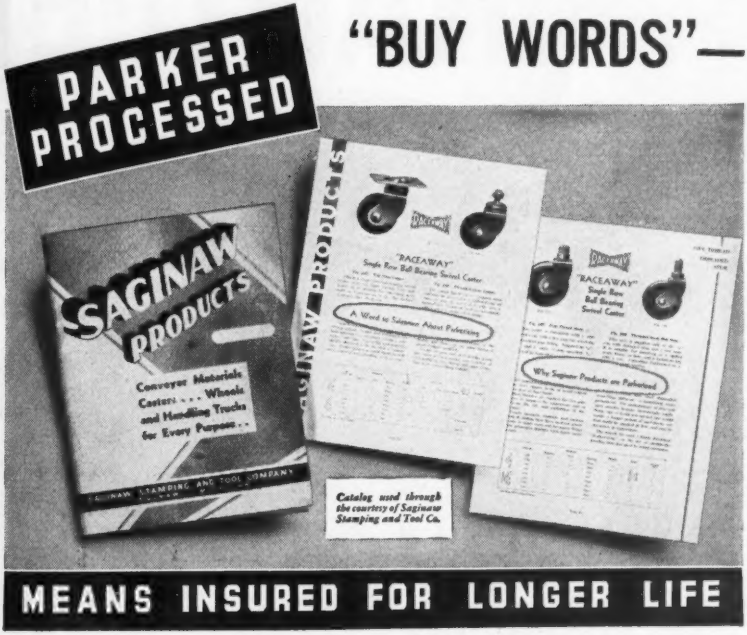
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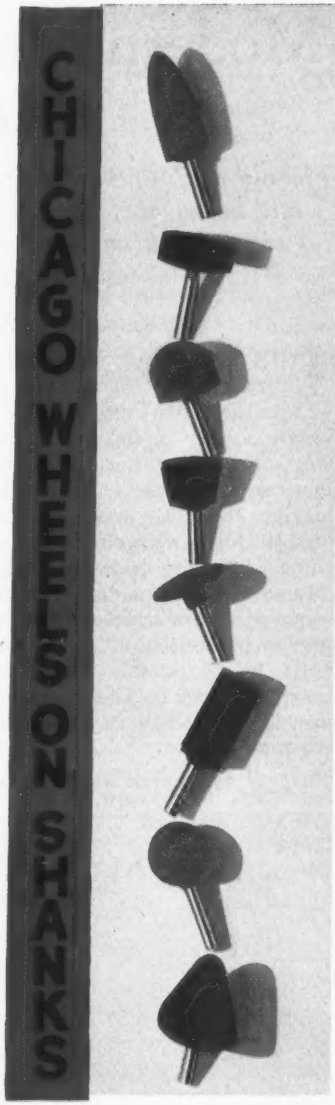

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Modern Methods of Cleaning Metal Parts

The old wash-tank, with its block and tackle, sloppy floor, and wet and bedraggled operator has been superseded by a "laundering" machine that does everything but iron and press the parts—and does it automatically and efficiently.

By Donald A. Clark

THE processing of metal parts through the various stages by which they are transformed from rough stock to finished pieces involves, usually, the use of coolants or lubricants in one form or another, leaving the parts more or less covered or filled with oil dust, or metal chips. In many cases this residue of oil and the dust or shavings must be removed in the course of the processing; in practically all cases the parts must be thoroughly cleaned before they can pass inspection and be approved for use in the assembling of the product.

Up to approximately 15 years ago the usual method of cleaning metal parts comprised the use of a tank, containing either hot water or a combination of hot water and a soap compound, into which the parts were dipped. The work pieces were usually handled by means of a block and tackle or chain hoist, small parts being dumped into a tray made of coarse mesh wire, and the larger pieces, such as automotive cylinder blocks, were handled individually by means of special tongs or hooks.

The washing operation usually consisted of moving the tray or part violently from side to side or up and down by means of the hoist. At best, the operation was a disagreeable and man-killing job, even for the low grade of labor usually used on such work, and the job was none too satisfactory when completed.

About this time, faced by production schedules of unprecedented extent and a high-cost labor market,

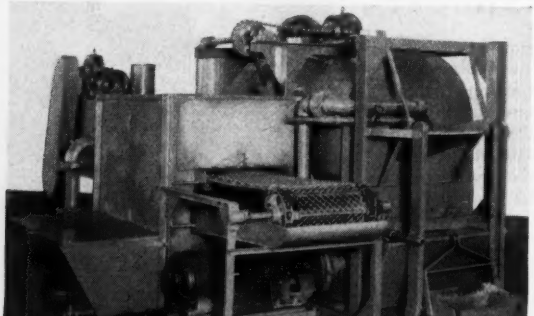

Fig. 1—Combination Drum and Conveyor-Type Continuous Process Washing Machine for Small Parts.

(Illustrations courtesy N. Ransohoff, Inc., Cincinnati, Ohio, builders of "Ideal" Industrial Machinery).

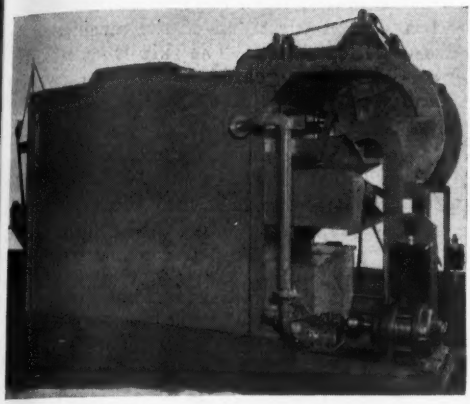

Fig. 2—This machine will clean a 2,000-pound load of bolts or nuts at a time and clean the container in time to receive the cleaned parts.

production officials began to realize that cleaning constituted a regular production operation, and that cleaning equipment would have to be devised which would be more efficient and less costly—in the long run—than the old tank.

Accordingly, those engineers who were best acquainted with the problem bent their energies toward the development of automatic washing and cleaning equipment, and today automatic equipment is available for washing and drying any kind or size of unit; for rinsing, dipping, pickling, painting, plating, burnishing, or for handling any combination of these operations. The parts to be processed are placed on a conveyor at one end of the machine and issue, finished, from the other.

No attempt will be made in this article to trace the development of the automatic washing machine; rather, the article will present a variety of machines of recent design, which have been developed to meet a variety of problems.

Parts that are machined dry can sometimes be cleaned sufficiently by blowing with compressed air, but parts that are produced in the screw machine always come from the machines dripping with oil and covered with fine shavings and chips. Obviously these parts must be cleaned before they can be passed to the assembly department, and inasmuch as the pan or tote-box in which they are transported is also covered with oil, the cleaning of the tote-box presents an additional problem.

The management of a large automobile plant wanted machines for cleaning both the screw machine parts and the tote-boxes, and in order to obtain the benefit of experience along this line, called in the engineers of a firm that specializes in automatic metal-cleaning equipment. These engineers

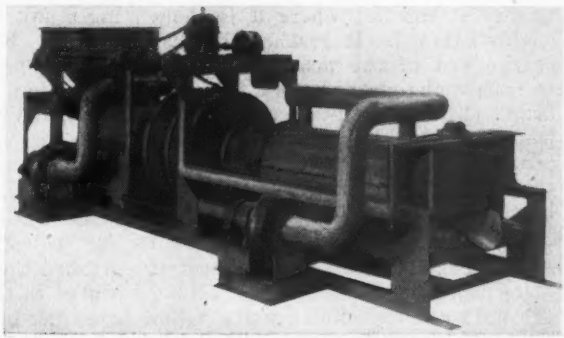

Fig. 3—Small parts such as washers, screws, and so on are washed, rinsed, rust-proofed, dried, stained, and dried automatically in this machine.

made a survey and then devised a compact unit in which both jobs were handled simultaneously at an appreciable saving in labor cost, time and floor space.

The combination outfit is a dual washer, shown in Fig. 1. The tote-pan, loaded with screw machine products is raised from floor level on a carriage that is operated by an air hoist, which charges the work into the cylindrical washer at the right. The work is washed while submerged in a hot cleaning compound, then rinsed by a fresh water spray.

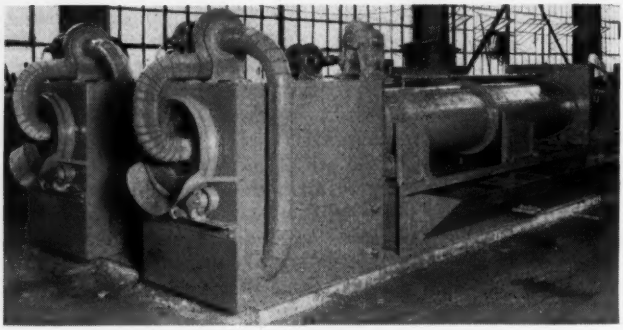

Fig. 4—A double installation of machines at the Frankford Arsenal, used for cleaning cartridge clips and cases.

Meanwhile the tote-pan travels, upside down, through a conveyor washer at the left where it is thoroughly cleaned. It reaches the discharge end of the machine in time to receive the cleaned work from the drum. The two units operate independently, and the conveyor unit is always available for washing parts that are too large or too delicate to be put through the drum.

Fig. 2 shows a machine that will clean, in one lot, a 2,000-pound load of bolts or nuts. The boxes containing the nuts are deposited from a roller conveyor into the loading skip, shown at the left end of the machine in the illustration. The skip is controlled by a worm-geared motor with reversing push button switches and limit switches.

The loading skip picks up the container, turns it upside down, and deposits the load into the drum of the washing machine. The container then passes through the machine on a conveyor, the interior being thoroughly cleaned en route, and is deposited at the discharge end of the machine just in time to receive the washed parts as they emerge from the drum.

Cleaning millions of small metal parts preparatory to rust-proofing, drying them after rust-proofing, painting them, re-drying them—those were problems that confronted production officials in one of the General Motors Corporation's plants at Pontiac, Michigan. Two assemblies of standard "Ideal" metal cleaning units were combined as shown in Fig. 3, forming a unit that resulted in faster production, better functioning of coordinate processes, fewer rejections in inspection, more rapid assembly of parts, and a definite reduction in labor cost.

In the unit shown, such parts as wood screws, lock washers, cap screws, and miscellaneous small parts for bodies are received at floor level, washed thoroughly in the first drum, rinsed in the second, and delivered to the rust-proofing compartment. The rust-proofed work is fed slowly and

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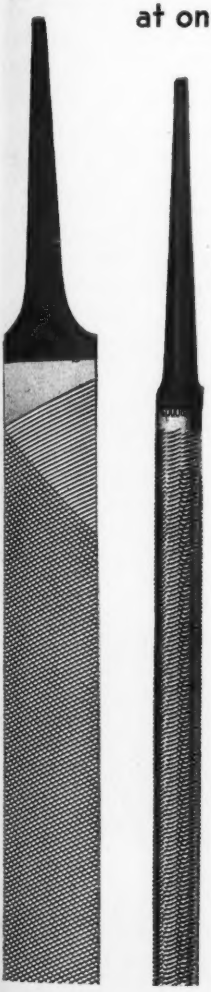

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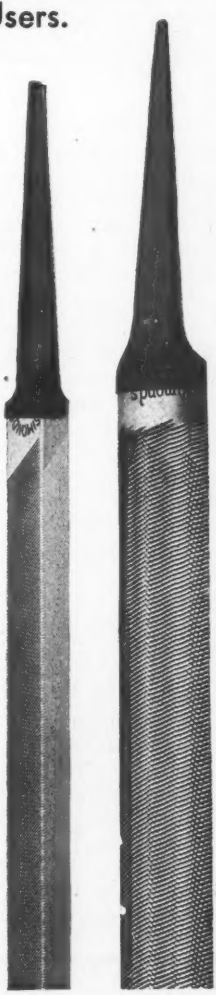

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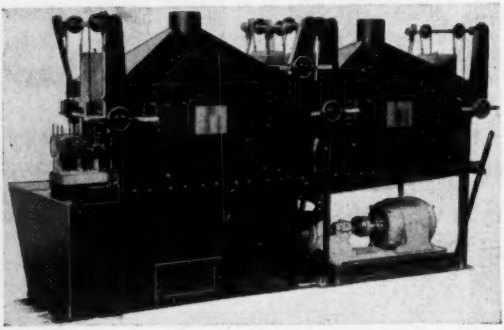


Fig. 5—Washing Machined Cylinder Blocks in an Automobile Plant.

automatically into a drying screen that is heated by steam coils, with fan-driven air currents. The dried parts pass into the dipping drum where they are given the desired paint finish and thence to a draining screen and to a final drying screen.

The spiral worms and dumping cups inside the drums are welded to the drum itself with such accuracy as to guarantee that even the smallest part will not stick. Batches of work of different character follow each other through the machine, each batch retaining its identity and never becoming mixed with the batch of work ahead nor the batch behind.

Before the war, the making of cartridge cases and clips at the Frankford Arsenal included rinsing and drying by a series of separate operations in which a great deal of hand labor was involved. Tanks and small tilting barrels were employed, the batches being transferred from one barrel to another by the help of small hoists. The war stepped up production schedules and faster methods requiring fewer men, were sought. As a result, a cleaning machine was installed which was later replaced by the two complete cleaning assemblies shown in Fig. 4. The machines are identical in design.

The work is fed into a hopper at the charging end of the machine, from which it automatically feeds into the drum. The first section of the drum is solid and is equipped at the end of the solid section with a patented lock washer drum head with dam, which holds a level of hot cleaning compound in the solid section and at the same time will pass the work

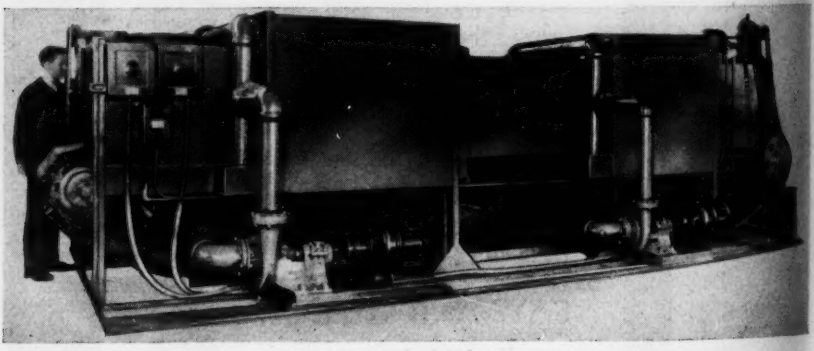
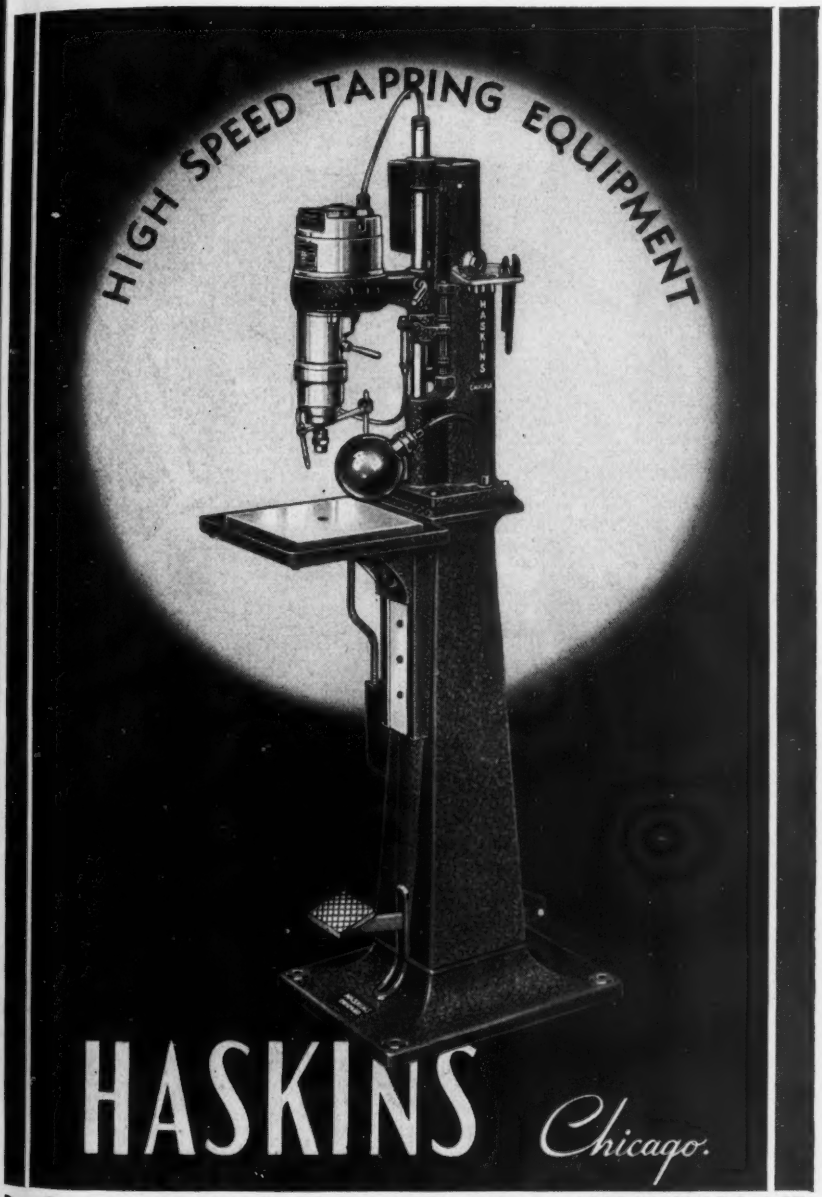


Fig. 6—Conveyor-Type Machine used to clean aluminum crankcases and other large parts in an automobile factory.



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through the drum head without dropping.

The work is given a soaking wash in a hot, flowing cleaning compound, followed by a spray in the first section of the draining screen. This spray effectively removes the dirt which has been softened in the soaking wash. In cases where the work is very dirty or where a particularly clean job is required, the wash may be followed by a fresh water rinse. The drier at the end is heated either by steam coils and a circulating blower or by a re-circulating gas air heater. The design of the machine is such as to permit the handling of delicate work without danger of marring threads or sharp corners. The washing and cleaning of roller bearings is handled in this manner.

An interesting piece of equipment for cleaning cylinder blocks before assembling, shown in Fig. 5, has been installed in an automobile plant in Detroit. The block reaches the cleaning machine riding on a wood pallet on a roller conveyor which carries it into a vapor-tight chamber, where it encounters an automatic stop. From a large number of correctly-placed nozzles Oleum spirits are sprayed onto and into the casting, the nozzles being so arranged as to register accurately with all the valve holes and with the cylinder bores. The solvent loosens all grease, oil, dirt, chips and other foreign matter.

The dirt, having been loosened, the operator releases the block and allows it to travel into the next compartment, where a second series of nozzles, similarly placed, plays the casting with air under high pressure. The air removes the loosened dirt and blows out such excess spirits as may have remained in pockets in the casting. The nozzles are so mounted that the simple pull of a lever repositions the nozzle assembly to register with different sizes of cylinder blocks. Thus two different sizes of blocks are handled by the machine without change of equipment.

The cleaning spirits are circulated under 35 pounds pressure by the use of a direct motor-driven centrifugal pump. As the spirits are too valuable to waste, a distillation system has been provided by which the contaminated spirits are redistilled and all grease, oil, chips, rust and other foreign matter removed. The cost of distilling is low. Loss due to evaporation in the cleaning machine is negligible due to the vapor-tight chamber, and thus the entire cleaning operation is quite inexpensive.

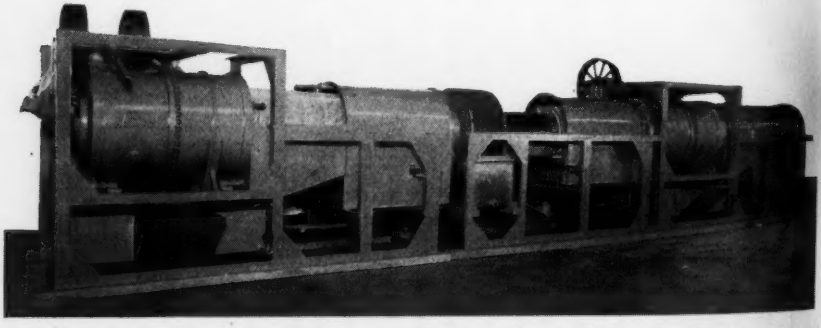

Fig. 7—In this machine aluminum caps for cosmetic jars are washed, rinsed, pickled, rinsed twice and dried.

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Another automobile manufacturer cleans large aluminum crankcases and other large parts in the machine shown in Fig. 6. This machine has a washing chamber 60 inches long, with a rinsing chamber 48 inches long. The washing operation is performed by streams of cleaning compound which are projected onto the work under a pressure of 45 pounds.

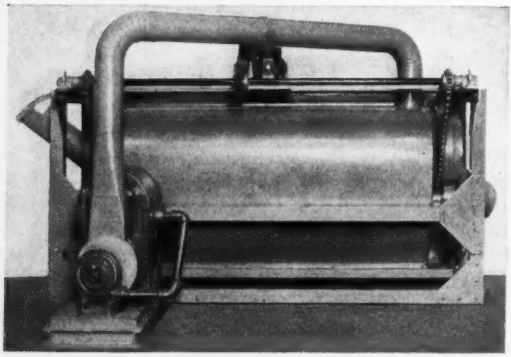

Fig. 8—Gas Heated Air Blast Drier, used with the machine shown in Fig. 7 to dry radio parts after they have been washed, rinsed, pickled, and rinsed twice again.

The streams issue from holes in pipes which extend across the path of the conveyor.

With this arrangement of the nozzles, the stream can be concentrated at any point where the cleaning is particularly difficult. The conveyor consists of bars connecting the parallel chains with a wire mesh belt over the bars so that the cleaning compound can be directed at the work from both sides, the top, and the bottom. In this particular instance, a 5-inch pump with 15 h.p. motor supplies the cleaning fluid and a 4-inch pump with a 10 h.p. motor provides water for rinsing.

The machine shown in Fig. 7 is used by a number of different manufacturers for cleaning different kinds of parts—mostly of a smaller nature. For instance, a large manufacturer of small glass cosmetic jars uses one of these machines for cleaning the pressed aluminum caps with which his jars are equipped. A large and well-known manufacturer of radio receiving sets uses this machine in the cleaning of the parts that go into his product.

The cosmetic jar caps are given a brush finish, but in order that the finish may adhere to the metal, the caps must be clean and absolutely free of press grease. Preparing the caps for the finish formerly required several operations, each of which added definitely to production costs and limited output. After a survey by the engineers of the cleaning equipment, a series of standard units were assembled into the machine as shown, with the result that cleansing operations are handled in continuous sequence.

As the caps come from the presses, they are washed in a cleaning compound, rinsed, pickled in concentrated nitric acid, rinsed twice, and dried. All operations are performed automatically. Owing to the extreme lightness of the parts, provision had to be made for sinking the pieces in the solution and to prevent them from sticking to the wall of the drum.

In the washing of radio parts, the parts are dumped from trays or tote-boxes into a power loading skip which charges the washing machine. The operation of the machine is continuous. In the first drum the work is given a thorough soaking wash, followed by a spray wash with cleaning compound under 35 pounds pressure. The spray removes the soaking wash.

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passes to a rinsing drum, thence to a drum where it is pickled in concentrated hydrochloric acid, and then to another rinsing drum. The last rinsing drum discharges the dirt that has been loosened by the work direct into plating barrels.

After the work has been plated, it is rinsed through two drums and discharged to a rotary gas-heated drier, shown in Fig. 8. The drier consists of a revolving screen with a worm and a hood to prevent radiation, heated by a Maxon Premix gas air burner. A high speed blower directs the blast of heated air onto the work. The worm spreads the work out as it travels through the drier. One of the parallel lines of equipment is terminated with two drier units instead of one, giving small work a greater opportunity to spread out and thus assuring a thorough drying. Batches of different kinds of parts can be run through the entire series of processes on a three-minute headway without danger of mixing.

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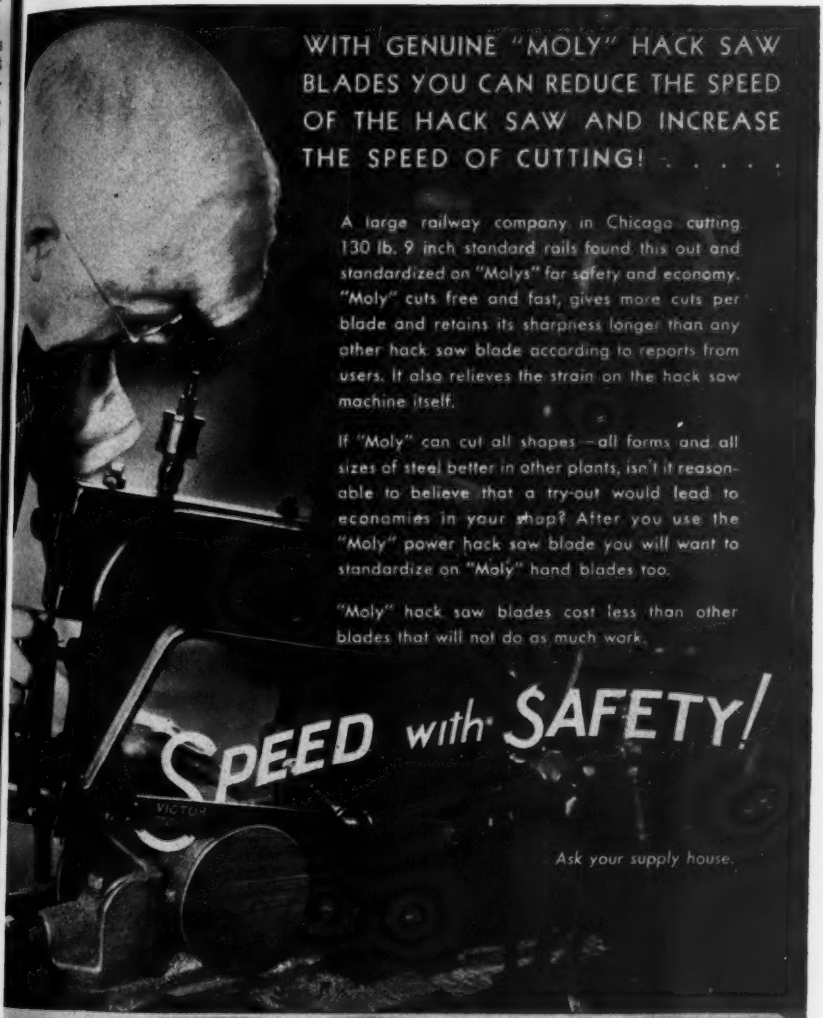

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"Toolmakers to American Industry"

Located "down by the old mill-stream", this very modern tool and die shop occupies a 117-year-old plant in which the water wheel that originally furnished the power is still running.

By Philip Winter

IF PLEASANT surroundings and a quiet, peaceful atmosphere have any influence upon the quality of the work that is produced under such conditions, herein probably lies one of the reasons for the success of the Urbana Tool and Die Company, Urbana, Ohio. This company occupies the building shown above, which, with modifications, has stood for one hundred and seventeen years. The building originally belonged to a woolen manufacturing firm who had operated a woolen mill here for ninety-nine years. The waterwheel that originally furnished power for the mill is still running, although now it serves only to pump water to various places about the plant.

The Urbana Tool and Die Company was formed 23 years ago, when the need for special, independent tool shops first became urgent. The real beginning of the modern tool and die industry was due to the automotive industry being placed on a mass production basis. About twenty-five years ago, when a certain prominent manufacturer started mass production of his car, he discovered a shortage of good tool and die makers. The same difficulty was presently faced by other automobile manufacturers. In consequence, it was found necessary to send some of their special jig, fixture, tool and die work and special machine work to jobbing machine shops outside of their own plants.

The growth of the tool and die industry during the past twenty-five

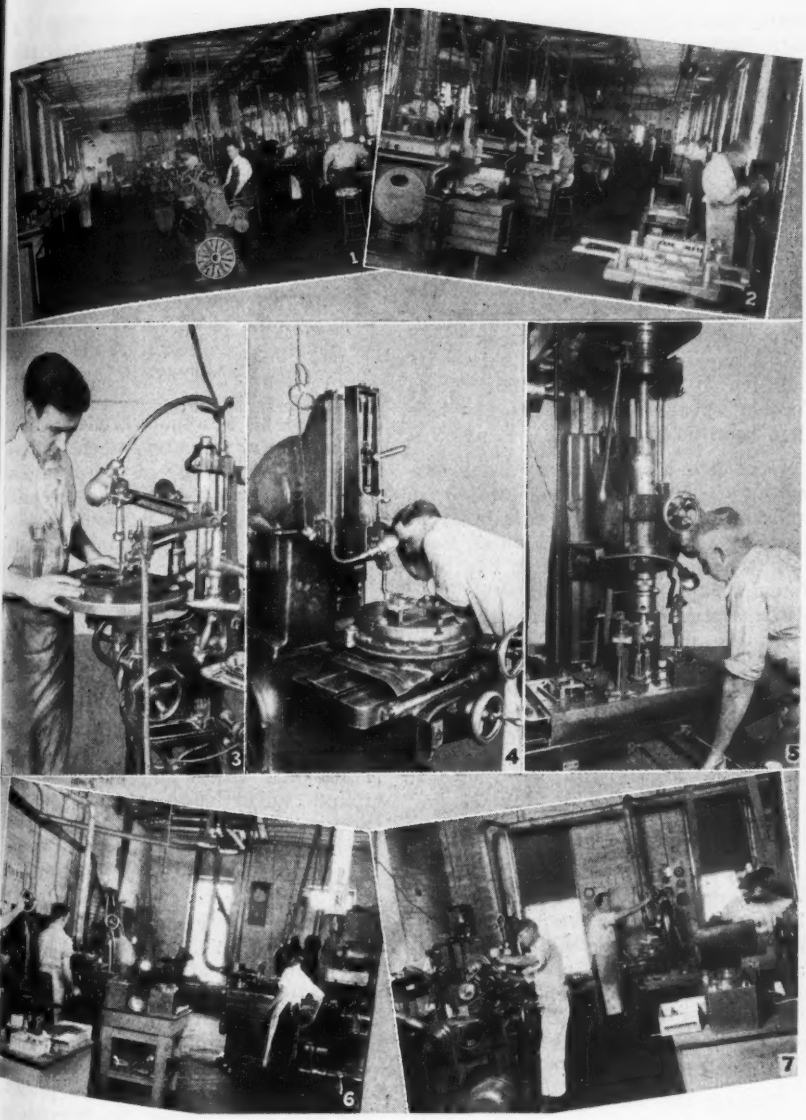


Fig. 1 and 2—Views down both sides of the main building of the Urbana Tool and Die Company. Fig. 3—Sawing a slot in a die, using a modern die filing and sawing machine. Fig. 4—Machining a part for a die in a Pratt & Whitney 6-in. vertical shaper. Fig. 5—Boring a part for a winding machine, using a jig-boring machine. Fig. 6 and 7—Views in the grinding department.

years has been remarkable. Today, each part of the average manufactured article is made by the interchangeable method, and mass production is the keynote of all industry. During these years, where once a customer was satisfied with 20,000 blanks per grind from a die, he now expects from 100,000 to 150,000 per grind. Consequently much greater care must be used in the making and hardening of the dies. The two most important reasons for the existence of a tool and die plant are accurate workmanship and the maintenance of delivery promises, and upon these foundations have the business of this firm been built.

Urbana is a small town of approximately 8,000 population, located in mid-western Ohio. The suitability of locating such a plant in a small town might be questioned, but it has been found that the smaller community has its advantages. The making of modern dies and tools requires a very high order of ability and men who possess this ability are usually of the substantial type who become permanent and useful residents of the community in which they reside. This factor is of no small importance in the successful operation of such a concern.

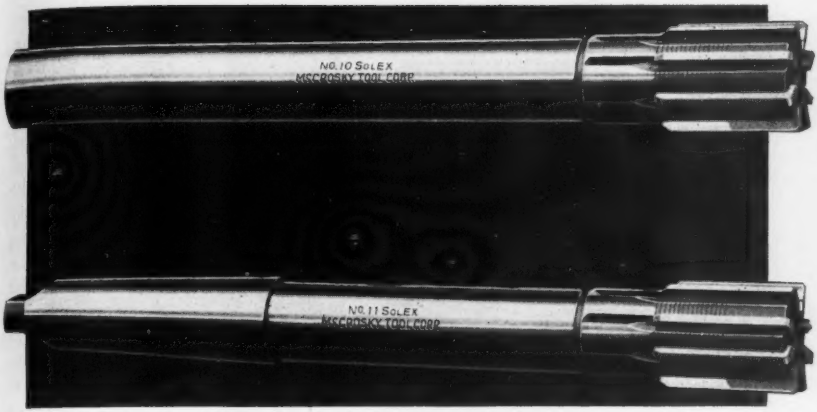
The plant of the Urbana Tool and Die Company stands upon a tract of 13 acres. At one side of the main building a beautiful small lake of five and one-half acres offers a variety of fishing, privileges of which are limited to the organization. The writer has seen a 23-pound bass that was caught in these waters.

During the twenty-three years of its existence, and during all the depression period, a remarkable fact is brought to light in that the Urbana Tool and Die Company during all that time has never been without an order, except for one-half hour of a day in 1933. This is a remarkable record, when we consider that 99 per cent of the orders to this firm come from outside of Urbana.

In fact, this company has more than 500 customers located from coast to coast and from points in Canada to the Mexican border. By reaching out to these more than 500 customers of varied industries, a steady even-flowing stream of orders has been kept coming into this plant which keeps the men steadily employed the year round; whereas, if this firm catered to only one or two industries, such as the automotive, electrical or other similar industry, when the peak period of these one or two industries had been passed each year, the plant would be idle and it would become necessary to lay the tool and die makers off.

It might be asked how this firm has been able to bring its facilities to the attention of more than 500 leading manufacturers of the whole United States. Change of officials of different firms who are already customers to other concerns has brought many new orders to this plant. National advertising, circular letters, and so on, have all played their part. One of the leading factors is the confidence this firm has established in the minds of its customers. In executing orders for a firm, the Urbana Tool and Die Company has always been most careful to keep inviolate any secrets pertaining to that customer's work, although they may have inquiries for quotations for similar tools from other customers. They pride themselves on always protecting and maintaining the interests of their customers.

In connection with this thought of the long list of customers it might be interesting to note that a large num-



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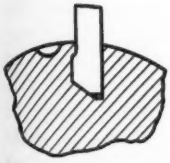

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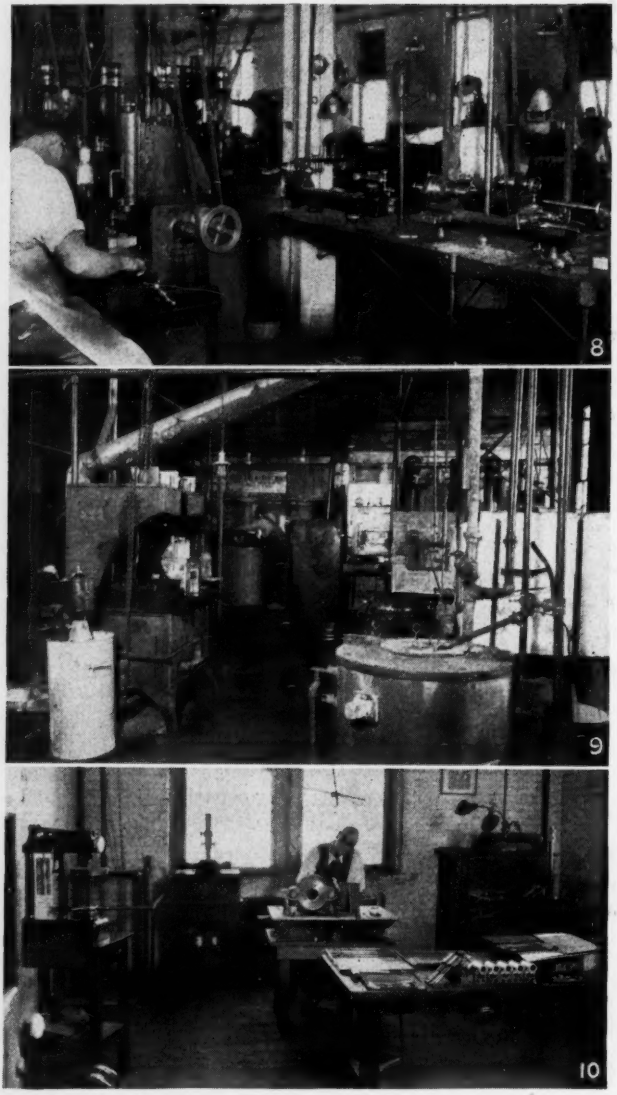


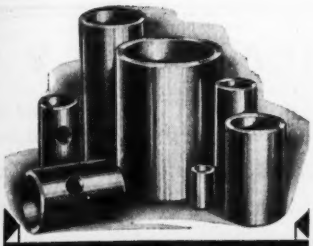
Fig. 8—At the left a mechanic is using a Rhodes vertical shaper; at the right is a bench with three high-grade bench lathes. Fig. 9—The heat treat department contains a couple of Strong, Carlisle and Hammond carbonizing and hardening furnaces, a high speed steel furnace, a hardening and tempering furnace, a lead pot, a "Homo" tempering furnace, and a drawing bath, in addition to other equipment. Fig. 10—The inspection department.

ber of manufacturers are today buying punch presses and special machines for the production of single parts and as a result, the machine tool builders and the tool and die makers have been thrown closer together and a real spirit of co-operation has developed between them.

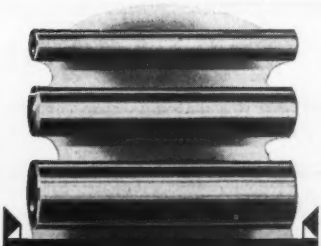
One amusing incident in connection with this firm's gaining customers occurred near its start. It was noted that an electrical firm was in need of tool and die workers. The Urbana Tool and Die Company sent a wire to this firm soliciting their work. The superintendent replied with a letter, stating that he was not having any work done outside his plant. In a few weeks another wire was sent, and a reply received the same as the first.

In a few weeks another wire was

(Continued on Page 90)



STOCK BUSHINGS AND BEARINGS



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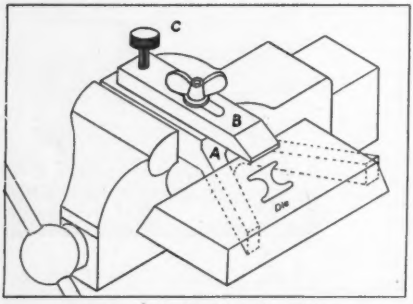
IDEAS FROM READERS

This department is a clearing house for ideas . . . If there is a "kink" or short cut in use in your shop, send in a description of it . . . Each one published will be paid for.

A Die Filing Kink

By Peter L. Budwitz

THE accompanying illustration shows a device or holder made for a vise and used to hold dies to facilitate the filing. Although this device is not intended to replace the filing machine, nevertheless those shops that are not equipped with one will find a holder of this type useful. However, when a die is filed on a machine there is some hand touching up which must be done especially on intricate forms. One of the objects of the holder is to enable the die to be held out free from any obstructions arising from the vise or bench; a swivel-base vise will increase its efficiency greatly.



Device to hold Dies for Filing

The holder permits the workman to seat himself conveniently at his work and at the same time will enable him to readily view the work-lines from the top. The filing is done in a vertical manner, gripping the file under the die with one hand and using a motion similar to that of a filing machine. At first one may experience some difficulty in becoming accustomed to filing in this manner, but with a little practice excellent results can be produced. Filing pressure should be applied toward the vise, in other words, filing at the lines nearest the vise.

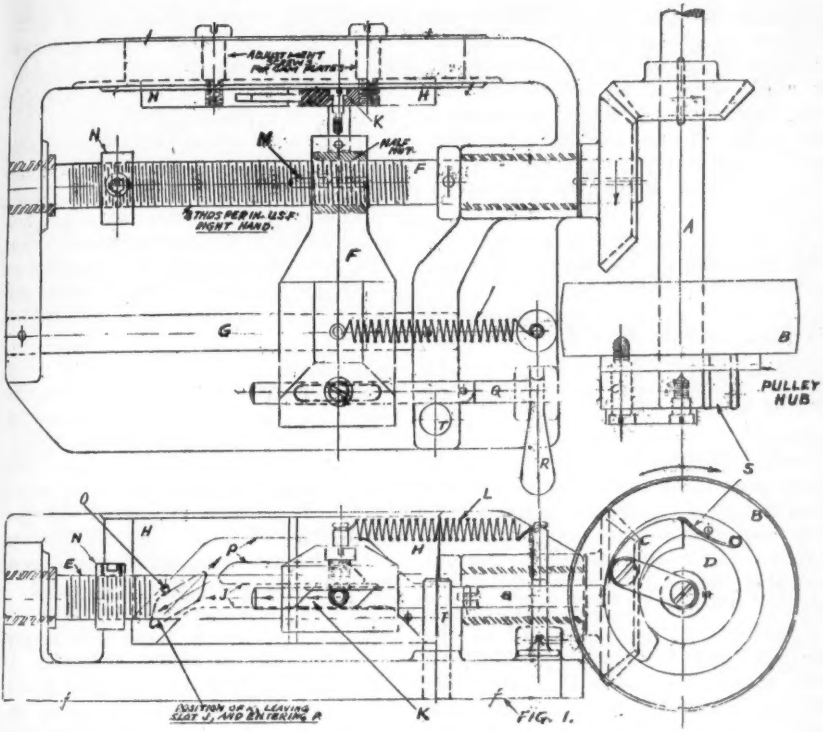
The device consists of a fork shaped piece as indicated at **A** in the sketch. A hole is drilled and tapped in the shank of the fork for a winged screw; the screw being used to tighten clamp **B**. The thumb screw **C** is used as a substitute for blocking and can be adjusted to meet various thicknesses of work to be held for filing.

Device to Count Revolutions and Stop a Machine Automatically

By C. W. Hinman

IN ORDER to count a given number of sheet metal laminations into the opening of a radio transformer coil, using an assembling fixture that is operated by a hand crank and which delivers two or more laminations per stroke, it is necessary to use a revolution counter attached to the fixture. The drawing shows the design of a device that not only counts the revolutions, but will also automatically disengage the clutch and stop the machine when the desired number of laminations have been inserted.

There are also other uses for the



Drawing Showing Design of Device to Count Revolutions and Stop a Machine Automatically

device; for instance, when feeding wide sheets of coiled material into a press feeding machine, the device can be utilized to halt the sheet when a given number of blanks have been cut. By counting the revolutions and stopping the machine, the feeding lengths of the material for successive blanks can be determined.

The device can be proportioned to suit light hand fixtures or medium-heavy power machines. It is 100 per cent accurate for counting, and will indicate the material in a sheet within one-sixteenth of an inch.

In Fig. 1, **A** is the main driving shaft on a machine that is to be stopped automatically when a predetermined number of revolutions have been made. This shaft is driven by the loose pulley **B** when pawl **C**, attached to the pulley hub, is engaged in toothed wheel **D**. Wheel **D** is positively keyed on the main shaft.

Lead screw **E** is driven by a pair of miter gears from the main shaft, and carries the half-nut **F** which slides on guide-rod **G**. Two adjustable cam plates **H-H** are made with a slot **J** in which the swivelled paral-

lelogram follower **K**, attached to the half-nut, is guided. The object of the straight slot **J** is to hold the half-nut in mesh while it travels toward the left, during which time it also tenses the coiled spring **L**; the tensioning pull would otherwise prevent the nut from leading along on the screw properly.

Continuing its travel toward the left, the follower is turned slightly, as shown, by contacting pin **O** in slot **J**, causing the right-hand end of the follower to enter slot **P** in the cam plate. Simultaneously the half-nut is raised out of mesh when its positive pin **M** becomes engaged over the top edge of revolving cam **N** (see plan view). The tension spring is now free to act, and instantly returns the half-nut to the right. The nut clears the lead screw when returning, because it is elevated in slot **P**. An adjustable hinged thrust rod **Q** is carried in the nut, and the forward end of this rod contacts the tail of the engaged pawl **C** (while in revolution), this action disengages the pawl from the toothed wheel, and stops the main shaft.

It is evident that the lateral position of cam **N** on the lead screw determines the number of revolutions made by the machine, and by this adjustment, together with the lateral adjustment of the thrust rod, and cam plates, any number of desired revolutions can be obtained within the range of the lead screw.

The sketch shows this automatic counting attachment in its normal position, the pawl is disengaged, the main shaft is at rest, and the loose pulley continues to revolve.

To start the machine, the shift lever **R** is depressed by hand, this action shifts the hinged thrust rod **Q** out of contact with the pawl **C**, and allows spring **S** to re-engage it. The machine then starts, the nut **F** begins its return toward the left; the hinged thrust rod is straightened in passing against post **T**, and the entire cycle of operations, just described, is repeated.

Using a fly-wheel that would cause shaft **A** to run ahead after the pawl is disengaged should be avoided, otherwise the tooth in wheel **D** might not stop near the vertical position shown, and this might permit the machine to make an unexpected start when the tail on the pawl passes the end of rod **Q**.

Stopping the machine close to a fractional number of revolutions, like 25.40, is supposed to be governed by the machine load, which is usually constant in all the stops. If it fails, then an automatic locking device, or prony brake, is arranged around another pulley on shaft **A**, controlled by an air cock that is automatically opened by the right hand return of nut **F**.

If greater driving strength is needed, the pawl is made broader and a larger fulcrum pin is employed. If the machine load is heavy and a sudden jolt occurs when the pawl engages, this is overcome by inserting spring pins in the tooth of wheel **D**, as shown in Fig. 2. The spring pins counteract the shock, the same as a similar arrangement of coiled springs in an automobile clutch absorbs the starting shock.

The attachment is sometimes used without a thrust rod, pawl or toothed wheel. In this case, when the nut is released and it arrives at its normal position at the right, it trips an electric switch and stops the machine by withdrawing a magnetic clutch, or by releasing a throw-out lever.

Another desired condition is one in which the nut trips an electrical switch at the left end of its travel, and there stops the machine. It is then returned by the tension spring to its normal right hand position,

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where it trips another switch and starts the machine. When using electrical switches it is good practice to have the nut trip two switches in succession. The first switch slows the driving motor to half speed, while the second switch completes the stop.

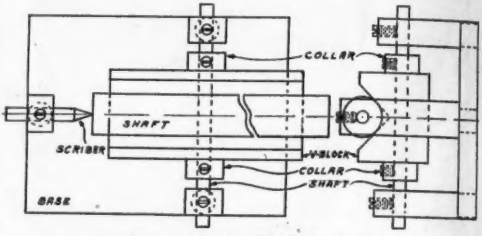
Electrical stopping switches are often found more convenient than the design for mechanical stopping shown in the sketch; when electric switches are used, only the counting unit is necessary and it can be located in any convenient driving position on the machine. In such a case the use of miter gears may be avoided and it is not necessary to locate the unit close to the clutch. If more revolutions are needed than are allowed by the range of the leadscrew, the driving ration can be changed by substituting a different pair of gears.

A Center-Finding Scribing Tool

By K. C. Charles

THE tool shown in the illustration was designed by the writer for scribing center lines on short shafts of various sizes, the feature of the tool being that it will find and scribe the exact center of a shaft regardless of diameter. It consists primarily of a rocking V-block, set in exact alignment with a scribing tool so that as the V-block is rocked, the end of the stock is moved up and down past the point of the tool, thus inscribing a line. The stock is then given a quarter turn and the operation is repeated. The intersection of the two lines is the exact center of the shaft.

The entire outfit is mounted on a cast iron base, and the V-Block is mounted centrally on a substantial shaft that passes through a hole drilled crosswise in the body of the block. The scriber is mounted in a block or holder of a height that brings the point of the tool to the approximate height of the center of the work. The diameter of the work



Design of Center-Finding Scriber

may vary, but the point of the scriber will always be on the vertical center line of the piece. Where there is a considerable amount of centering or laying off to be done, this tool will be found well worth its cost.

Repairing Wire Roll

By L. Kasper

IN THE repair of a set of rolls for rolling wire, the experience of the writer may prove of value to other readers. The rolls in question are made of an alloy steel in the form of rings, which originally were hydraulically pressed onto machine steel shafts. The bore of the rolls are recessed to provide a passage for cooling water. After being in service for several years, the rolls began to turn on the shafts. Though the amount of slip was slight, it nevertheless reflected in the product.

A new set of shafts was made 0.002 in. larger in diameter than the originals, though a greater allowance for pressing was not considered desirable for fear of cracking the rolls. After

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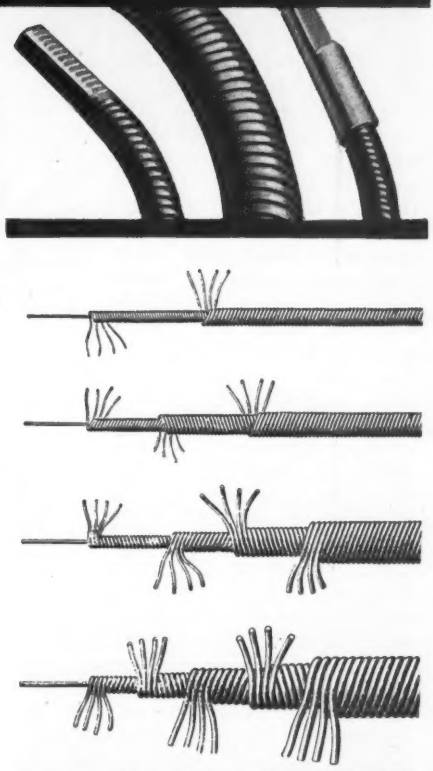

General construction of an S. S. WHITE Flexible Shaft. Shafts of widely different characteristics are produced by varying number of layers, size of wire, and other winding factors. As many as 12 different grades of shaft in one diameter have been produced. Flexibility of S. S. WHITE manufacturing process readily permits making a shaft with practically any required combination of characteristics.

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several weeks of operation, the rolls again slipped, and the bore of the rolls was found to have increased 0.001 in. in diameter. The following method was then followed, and after several months of operation seems to have eliminated the trouble.

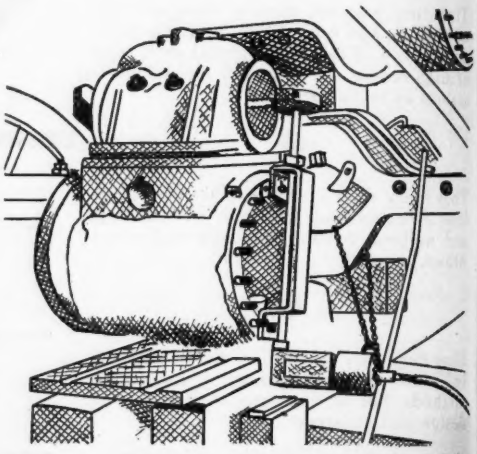
The shafts were placed in a lathe, and the surfaces contacting with the rolls were knurled with a diamond knurl until the diameter was increased about 0.015 in. These surfaces were then turned off until they measured 0.006 in. greater in diameter than originally. The rolls were then placed in boiling water until they became thoroughly warmed while the shafts were packed in cracked ice. The changes in dimensions were such that the shafts could be forced into the rolls by light blows with a hammer. The assembled rolls were then allowed to acquire atmospheric temperature before being placed in operation. The fear of water leakage, due to the knurling, was dispelled when a test under pressure failed to show any evidence of leakage. Evidently the knurling provides a softer surface which is more readily compressed than an unbroken surface, and the fact that no water leakage occurred indicates that the "hills" of the knurling were compressed considerably into "valleys."

A Handy Railroad Shop Tool

By John Malvitis

THE drawing shows how piston valve chambers are ground into the valve faces of locomotive cylinders in a western railroad shop. A pair of bearings are bolted to the front end of the cylinder, and through these bearings extends a shaft that carries an eccentric on the upper end. The lower end of the shaft is connected to the spindle of a close-quarter motor, the motor being large enough to provide power for the job.

A rod extends from the eccentric through the piston valve chamber and is anchored to a steel strap across the rear end of the chamber. When power is applied, the shaft revolves and the chamber is moved forward and back over the valve faces of the cylinder. Grinding compound is applied to the contacting surfaces at intervals as the operation proceeds, and a tight joint is obtained in from 2½ to 3 hours.



Device for grinding-in piston valve chambers to the valve faces of cylinders on a locomotive.

Another Solution to Mr. Hinman's "Trig" Problem

By Alban J. Carlson

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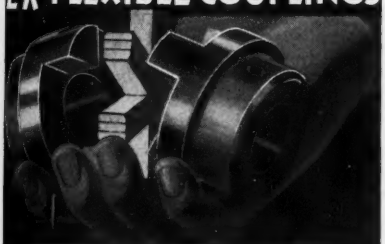

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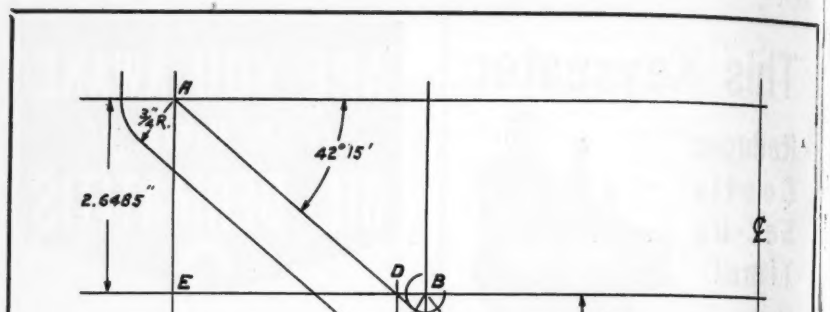


man's article "An Unusual Application of Trigonometry in Die Work" which was published on Page 36 of the February issue of MODERN MACHINE SHOP. To solve, using the diagram as shown, proceed as follows:

Draw a circle at B on a ¼-in. radius, the difference in radii being ¼ inch. Draw a line from point A tangent to this circle. Draw indefinite lines A-E and E-B. Draw line B-C 90 degrees to line A-C. We no[w] have two sides to solve; namely, sid[e] M in triangle A-D-E, and side N in triangle B-C-D.

Side M equals side A-E times co-tangent 42 deg. 15 min., or 2.915[7] inches. Side N equals side B-C time[s] cosecant 42 deg. 15 min., or 0.371[4] inches. Side X equals side M plus side N, or 3.2874 inches, which is the answer.

NORMA-HOFFMAN BALL AND ROLLER BEARING PILLOW BLOCKS. This bulletin, No. 934-A, has been issued by Norma-Hoffmann Bearings Corporation, Stamford, Conn. It includes illustrations and descriptions of installations of equipment in which various types of self-aligning "Precision" bearings, of either ball or roller type, are used.

A complete range of 2-bolt and 4-bolt pillow blocks with bearings is presented, together with several series of take-up mountings, machine mountings, and flange mountings (all with "Precision" bearings) adapted for various kinds of machine assemblies. Shaft sizes range, in the several types, from 11/16 inch to 8-inch diameter. Load ratings and mounting instructions supplement the specification data. Copy free upon request.

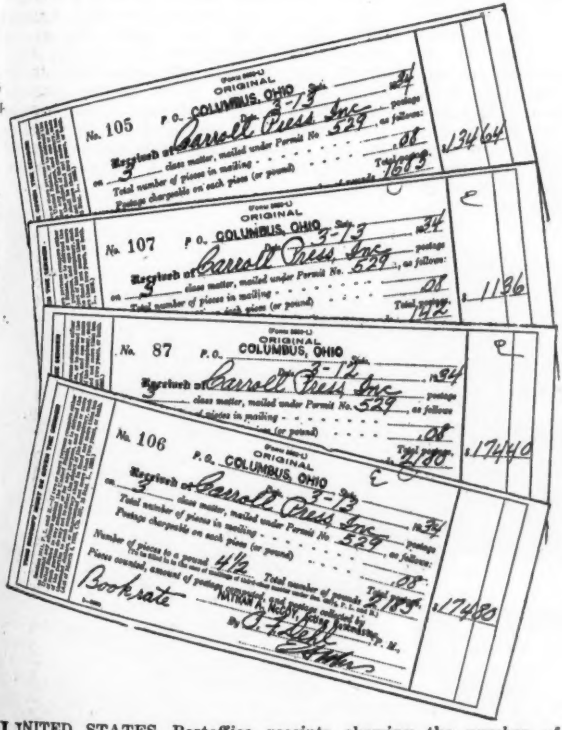
"MAKING STEEL MACHINABLE." The underlying principles of the machinability of steel are discussed, concisely but informatively, in a four-page, 8½x11-in. folder that has been issued by the Union Drawn Steel Co., Massilon, Ohio. The text draws a comparison between the machining properties of hot rolled and cold drawn steels, and discusses the effect of annealing upon the machinability of steels. Copies of this bulletin can be had upon request.

Over the Editor's Desk

THIS month we are going to use this space to thank those of our readers who, while returning the cards that were enclosed with their March copies of this magazine, so kindly gave us the information requested and in most cases also included the names of other men holding executive positions in their own or other metal-working plants.

In the two weeks that have elapsed since the March number was placed in the mails, thousands of the cards that were sent out have been returned to us, and they are still coming in with every mail. Every card will be checked against our circulation lists. Now that the wheels of industry are turning at a steadily-increasing rate of speed, we want this magazine to reach every metal-working plant in the United States—and the right men in those plants.

If you are holding an executive position in a plant that works with metals, you are entitled to receive this magazine without charge. If you haven't returned your card, fill it out and send it in. And may we suggest that you do it now, before you forget it or before you lose the card. Again we thank you.



4½ pieces per lb., 1,683 lbs. Total pieces	7,573
4½ pieces per lb., 142 lbs. Total pieces	639
4½ pieces per lb., 2180 lbs. Total pieces	9,810
4½ pieces per lb., 2185 lbs. Total pieces	9,832
Copies mailed to foreign countries, stamps affixed	117
Copies mailed in U. S. A., stamps affixed	92
Total	28,064

UNITED STATES Postoffice receipts showing the number of copies of the March issue that were placed in the mails are reproduced above.

NEW SHOP EQUIPMENT

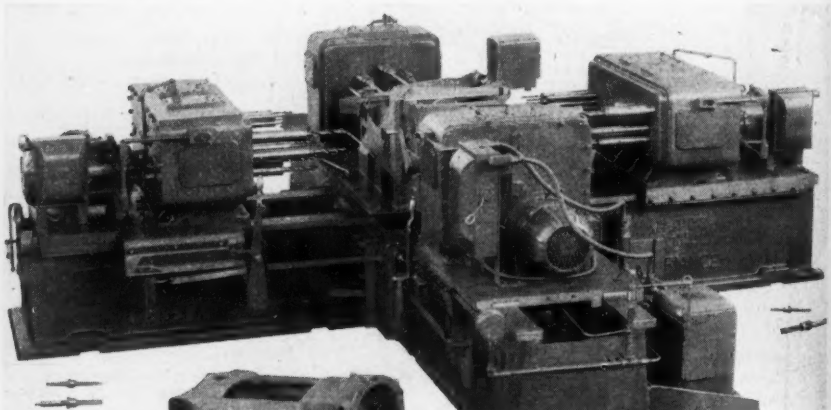
Defiance Extra Heavy Special Four-Way Horizontal Drilling and Reaming Machine

The illustration shows the Defiance Extra Heavy Special Four-Way Horizontal Drilling and Reaming machine, built by the Defiance Machine Works, Defiance, Ohio, for drilling and reaming 53 holes in main front tractor frames. The machine is shown equipped with multiple spindle heads for this operation.

The base of the machine is exceptionally heavy, of cored design with one center member that holds the fixture, and to this center member are attached four separate members which carry the slides upon which the multiple spindle heads and motors are mounted. The multiple spindle heads, which are mounted at right angles on the machine and are apposed in both directions, are fitted with high grade heat treated alloy steel spindles and gears. Heads are thoroughly enclosed with force feed lubrication and direct-connected motor to drive each head. The machine can be built with any number of heads or spindles in heads to suit requirements.

The fixture, which is removable, is of extra heavy box type and is equipped with guide bushings for drilling and reaming tools, with quick-acting screw clamps for locating and holding the frames in position. Two separate Oilgear pumps and cylinders for feed are provided under each head. Each pump drives the two opposed heads and the machine is so arranged that either two or four heads are in work at the same time.

Each apposed set of heads is equipped with cut steel rack and pinion for timing. Each Oilgear pump is driven by a 3 h.p. 900 r.p.m. motor, giving a production of 10 to 12 frames per hour, drilling and reaming all four sides. Motors for driving the heads are 15 and 7½ h.p.; speed 1200 r.p.m. The machine can be built with either plain bronze bearings or anti-friction bearings where centers will permit the inclusion of all spindles in the heads. The floor space required is 16½x15½ ft. Net weight, 35,000 pounds.



Defiance Extra Heavy Special Four-Way Horizontal Drilling and Reaming Machine

Reed-Prentice No. 3V Vertical Milling and Die Sinking Machine

The illustration shows a vertical milling and die sinking machine that has been brought out by the Reed-Prentice Corporation, Worcester, Mass. This machine is similar in type and design to the No. 2V machine which is also made by this firm, but is of more rigid design, larger size, and heavier construction.

The No. 3V machine, like the No. 2V Model, is powered by a vertical ball-bearing motor which is carried on a bracket that is fitted to the slide of the column. The bracket can be adjusted for belt tension, or to accommodate the various spindle speeds, through a screw that is controlled by a hand wheel. Power is transmitted through an endless V-belt and four-step spindle and motor pulleys, providing ten spindle speeds.

Motors of either 1200 or 1800 r.p.m. may be used. The 1800 r.p.m. motor provides speeds of 600, 740, 910, 1125, 1415, 1660, 2100, 2540, 3260 and 4000 r.p.m.; with the 1200 r.p.m. motor, speeds of 395, 485, 600, 740, 930, 1090, 1380, 1670, 2150 and 2630 are available. Where slower speeds are required, a 900 r.p.m. motor may be used.

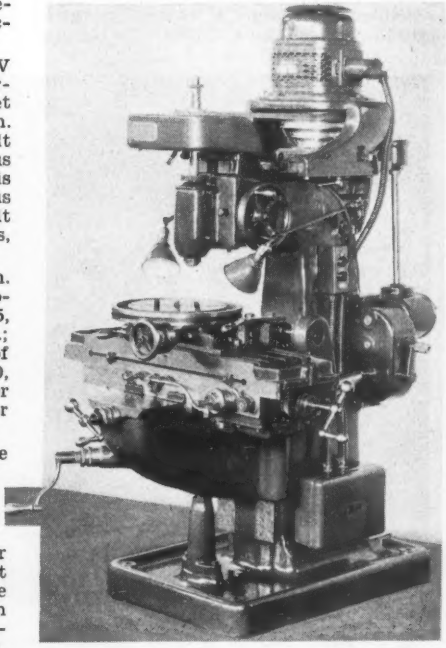
Pulleys are balanced for high spindle speeds. They are of heat treated aluminum alloy, in which light weight and strength are combined. The spindle pulley is guarded.

Feed is taken direct from the motor through helical gears and vertical shaft to the gear box. Six feeds are available for each spindle speed, with maximum longitudinal feed of 0.047 in. and minimum feed of 0.0004 in. per revolution. Longitudinal feeds per minute with the 1800 r.p.m. motor are 1.75 in. to 28 in.; with the 1200 r.p.m. motor they are 1.15 in. to 18½ inches.

Like the standard No. 3 machine made by this company, the longitudinal power feed is 21 in.; cross feed, 12 in.; vertical feed of knee, 17 in., and head travel, 3½ in. The maximum distance from spindle to table is 16½ in.; maximum distance spindle to rotary table, 12 in.; and maximum distance, spindle to frame, 16 in. The working surface of the rotary table is 16 in. diameter. The working surface of the machine table is 10¼x30¾ in., and the size overall is 10¼x38 inches.

Standard equipment includes the machine arranged for vertical motor drive but exclusive of electrical equipment, 5 in. plain base vise, drawbar, No. 2A or 3 Becker collet adapter, and one collet and wrenches. Extra equipment includes electrical equipment, oil pump and piping, foot treadle, rotary table power and hand feed type, universal angle plate, universal vise, profiling attachment, collet chuck and collets, and so on.

Electrical equipment recommended includes vertical type ball bearing motor with flange mounting in 1800 or 1200 r.p.m. constant speed. Reversing type of magnetic switch arranged for plugging with two-button push button station provides for quick stop of spindle and change of cutters. The illustration shows the machine complete with vertical motor and control, also rotary table and lamp brackets. Diameter of rotary table, working surface, 16½ in. Machine table, working surface, 10¼x30¾ in. Machine table, size overall, 10¼x38 in. Shipping weight, standard equipment complete with motor, 2,850 pounds.



Reed-Prentice No. 3V Vertical Milling and Die Sinking Machine

Heald No. 81 Internal Centerless Grinding Machine

The principles of centerless grinding which have been so successfully used for external grinding have now been employed in the development of an internal centerless grinding machine which has been announced by The Heald Machine Company, Worcester, Mass.

The principles of external centerless grinding consist primarily of passing a workpiece between a rapidly rotating grinding wheel and a slowly rotating regulating wheel upon a work rest or blade, one of the wheels being tilted to give the necessary feed to the work. In internal centerless grinding it is not possible to pass the work through the machine, but the rotating regulating wheel, together with a rotatable work rest or stationary blade and pressure rolls, is used.

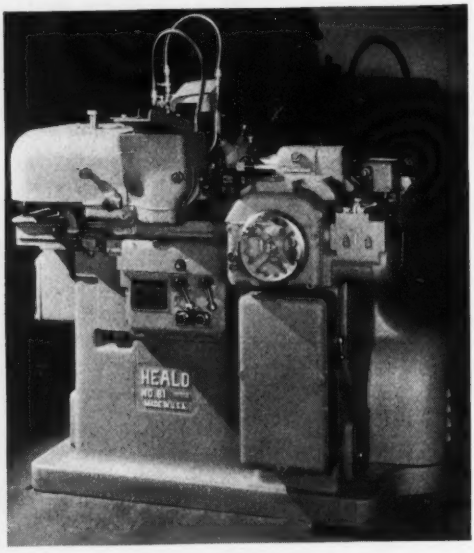


Fig. 1—Heald No. 81 Internal Centerless Grinding Machine

The regulating roll rotates and governs the rate of rotation of the workpiece while the grinding wheel is removing material from the bore. In this case the regulating roll takes the place of the grinding wheel of the external machine while the pressure roll takes the place of the regulating wheel, thereby providing the usual grinding throat.

By this method the outside diameter of the work is used to generate a path for grinding the bore, thus the bore is absolutely concentric with the outside diameter. This centerless holding principle makes possible simplified setup and automatic loading, it only being necessary to keep the loading magazine full and remove the finished parts. Work can be rechucked with perfect confidence that there will be no change in location where it is desirable to grind in two or more operations such as when roughing or finishing. The machine will automatically finish work to size by either the Gage-Matic or Size-Matic method.

With the work fed from a hopper, every function in loading and unloading the machine is automatically controlled. Figure 2 shows the work-pieces in the hopper and the work stop **A** which allows one piece at a time to be selected. In grinding position the work is held by the pressure roll **C** against the regulating roll **F**, where it is supported by the supporting roll **D**. When the piece is finished, it is automatically withdrawn from the wheel. Immediately the pressure roll **C** lifts out of the way and the loading arm **E** rises, lifting the piece over the top of the regulating roll **F** where it rolls down the unloading chute by gravity.

As the work is ejected, the work stop **A** rises, allowing a new piece to roll against the loading arm, and then drops. The new piece follows the loading arm downward to grinding position, the pressure roll returns, and the operation proceeds. The wheel enters the work with what might be called a "plunge" cut, to eliminate the danger of breaking down the corner of the wheel. The operation starts with the proper roughing feed and speed, then, at a predetermined point, the feed changes to finishing feed, relieving the strain and spring of the spindle before truing the wheel.

When the hole is nearly to size, the wheel recedes and the work withdraws from the wheel. The speed changes to truing speed, all feed stops, the diamond drops into position, the wheel is trued, and the wheel re-enters the hole. The finishing operation now proceeds with the proper feed and speed and when the exact size desired is reached, the wheel backs off and the work withdraws, com-

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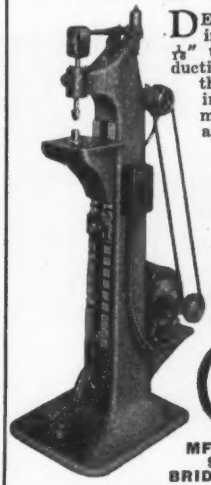

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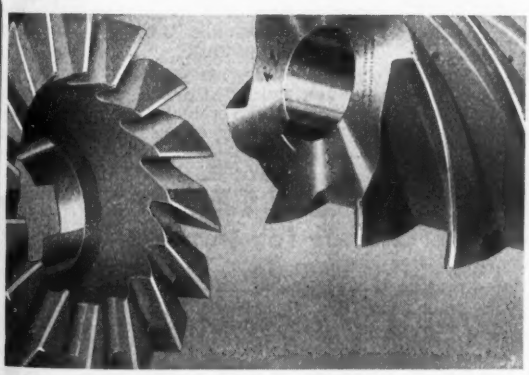

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pleting the cycle.

The base of the machine is a heavy, one-piece box-type casting, closely ribbed for rigidity and resting on a three-point bearing. On the No. 81 machine, illustrated herewith, the work regulating roll

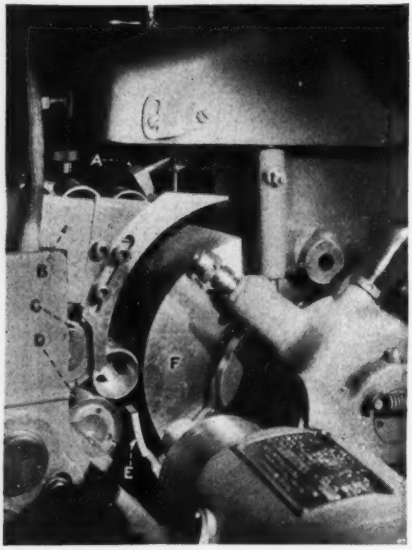

Fig. 2—Close view showing work holding and loading mechanism

unit is mounted on a reciprocating table while the wheelhead unit is mounted on a stationary bridge that spans the ways. Practically all controls and movements are hydraulically operated, including table reciprocation and cross slide feed.

The main drive motor for the pumps and wheelhead is self-contained and completely enclosed at the rear of t machine. An individual motor driv the work-head, permitting swivelling the head for taper work when the m chine is arranged for Size-Matic contr The motor controls are built in and a within easy reach of the operator. Ant friction bearings for all revolving mem bers have been carefully selected to mee the requirements of the individual ap plication. An oil reservoir is completel enclosed in the lower part of the bas

Warner & Swasey Motor-Driven High Speed Turret Lathe

A high speed turret lathe, with its mo tor built into the head of the machin and new bar feed, has recently bee brought out by the Warner & Swas Co., Cleveland, Ohio. The new lathe designed for higher cutting speed which are becoming increasingly des able, especially when carbide or diamon cutting tools are employed. It is parti ularly adapted to small diameter wo and non-ferrous materials, where hig speeds necessitate very high spindle re olution.

The machine incorporates for the fir time a completely self-contained alte nating current motor drive; the rotor mounted directly on the spindle, wh the stator is in the head housing. Fo speeds are available in either directio 600, 1200, 1800 and 3600 r.p.m. All gea ing and belts are eliminated, resulti in a simple construction that provid ample power, free from trouble and e cessive frictional losses. Perfect balan is easily obtained because there is b one rotating unit.

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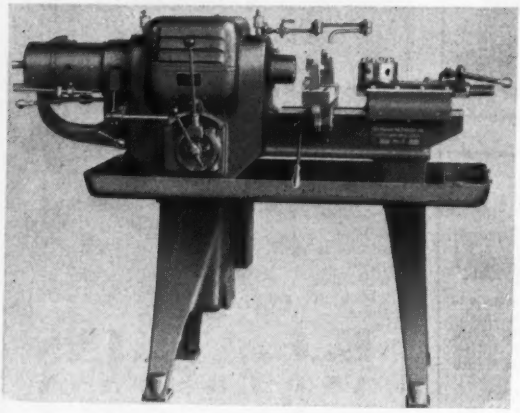
and around the motor windings.

Two levers control the spindle electrically through a drum-type controller and automatic relays. The shorter lever selects the four spindle speeds. The longer lever stops, starts and reverses. The spindle can be quickly reversed without damage to the motor, and the number of



Warner & Swasey Motor-Driven High Speed Turret Lathe

permissible reversals per minute is ample. A large band brake is actuated by the longer lever, in the neutral position, preventing rotation when attaching chucks, loading work, etc.

High speeds made possible by the new lathe have necessitated a new combination of bar feed elements. For this purpose a friction finger bar feed has been developed (also adaptable for other models of high speed lathes), holding bars in a concentric position in the spindle to prevent vibration, and enclosing them for their full length in a protecting tube for safety.

The friction feed finger lies immediately behind the collet so that bar stock can be used up to the last end. The finger is mounted on a feed tube, which at the rear of the spindle, is reciprocated by a fork. No cams are used. Simple hand lever action and toggle linkage feed the stock, close the collet, and return the feed finger.

Haskins High Speed Tapper

Tapping at speeds up to 3,000 r.p.m. is now possible and practical through the use of the Haskins High Speed Tapper, illustrated herewith. According to the manufacturers of this machine, it is so designed that tap breakage is practically eliminated, even in tapping blind holes.

The machine is of the vertical type, with tapping capacity of ¼ in. in non-ferrous metals and 3/16 in. in steel. Two speeds are available, which are undoubtedly sufficient for these small holes. The feed is automatic, eliminating the possibility of breaking a tap through unsteady or uneven pressure of the operator's hand. The feed is controlled by a foot pedal which is operated with slight effort, leaving the hands free to manipulate the work.

Work is held on a table which is adjustable for height. The top surface of the table is square with the spindle. The tapping head is powered by a repulsion induction motor which is equipped with

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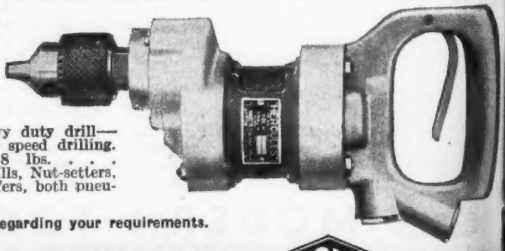

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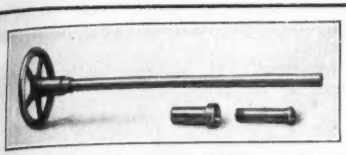

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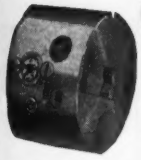

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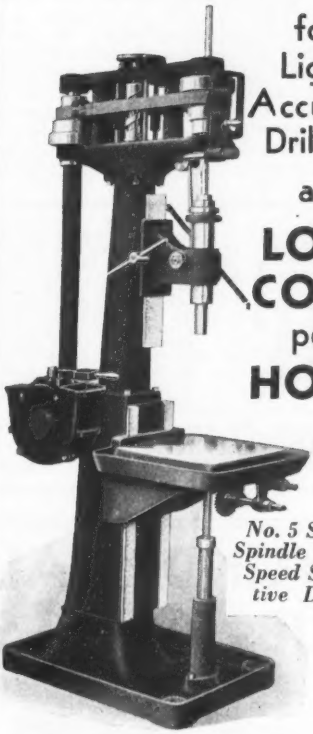

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ball bearings throughout. The switch is built into the motor end bell, convenient to the operator's hand.

The tapping head is held in position by a wedge lock, permitting quick change of gears to change the speed. Although extremely sensitive, there is no float in the tapping spindle. In operation, the spindle starts feeding down the instant the foot lever is depressed, and upon reaching the bottom of the hole it reverses instantly at double the tapping speed. A 3-in. range of adjustment is provided for the head, with side to side adjustment obtainable through the quick-acting wedge lock. Stops a conveniently located and easily ad justed.

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Haskins High Speed Tapper

work through a nozzle which is readil adjusted for volume of discharge. lubricant trough is cast integral with th table, draining into a tank on the sid of the machine.

The tap is held in a collet chuck tha is light in weight and built to run ab solutely true. The tap is driven by th square of the shank. A set of five collet is furnished as standard equipment.

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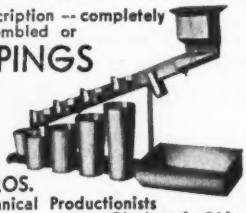
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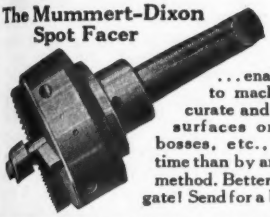
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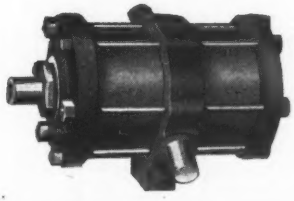
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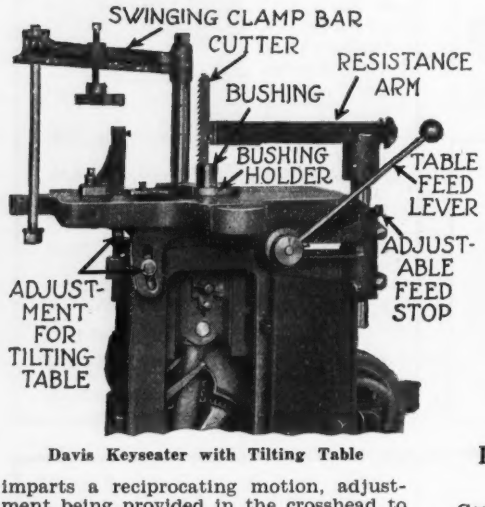
tilting table, keyways can be cut taper or at an angle, as desired.

The cutter used with the machine is similar to a saw or broach, having several teeth cutting simultaneously. It is said that it is impossible for this type of cutter to dig into the work. The cutter is fastened to a crosshead which imparts a reciprocating motion, adjustment being provided in the crosshead to bring the cutter central with the work.



Davis Keyseater with Tilting Table

The work-piece is set over a bushing, which is in turn clamped to the table by means of a suitable bushing holder. The cutter is guided by a slot cut in the bushing, the bushing thus serving the purpose of holding the cutter in proper relation to the work. A swinging clamp bar holds the work-piece in position.

The cutter is set up in vertical position and remains vertical during the entire cutting process. The feed is table-type, operated by a hand lever in connection with a pinion which meshes with a rack attached to the table. The table is slidably mounted on accurately-machined ways, with a gib for taking up wear.

For cutting taper keyways, the table may be inclined in either direction from the horizontal, a scale being provided to indicate the exact taper for which it is set. Motor drive can be applied to the machine is a simple manner as shown in the illustration. The motor may be either alternating or direct current and should be 2 h.p. with a speed of 1150 to 1200 r.p.m. Belt driven machines are supplied with tight and loose pulleys to avoid the use of a countershaft.

The machine is made in three sizes. The No. 3 size cuts keyways 1/16 to ½ in. wide by up to 4½ in. long; the No. 4 cuts keyways 1/16 to 1 in. wide by up to 8 in. long, and the No. 5 cuts keyways 1/16 to 1½ in. wide by up to 7½ in. long. Net weights are 600, 900, and 1200 pounds.

Langelier Horizontal Bench Tapping Machine

Continuing the policy of redesigning equipment and bringing it up to date the Langelier Manufacturing Company, Providence, R. I., is placing on the market its improved Langelier Horizontal Bench Tapping Machine. This machine is used for small light tapping operations in optical, radio, electrical, and similar small parts, has proved very successful because of its sensitiveness, ease of operation, and high production.

The spindle is equipped with a No. 1 Jacobs chuck and the machine has a

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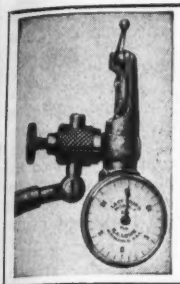

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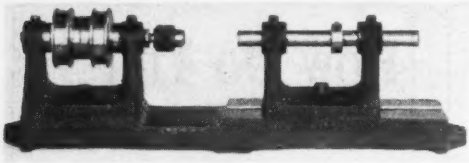

Langelier Horizontal Bench Tapping Machine

capacity of 3/16 inch in sheet metals. The drive is by means of open and crossed belts through a friction clutch, the spindle running inside a bronze sleeve on which the pulleys are mounted, eliminating any belt pull on the spindle and permitting it to float and change the direction of rotation very easily.

A tailstock is provided with a shaft having a tapered socket so that fixtures can be used, if necessary, to align the work on the tap. The distance from the bed to the center of the spindle is 3¼ inches and the bench space required is 22 inches front by 4 inches depth.

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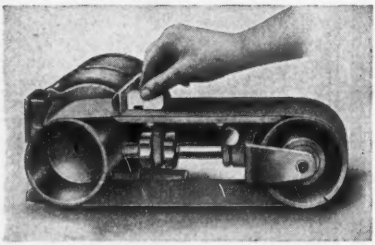

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Hammond Variable Speed Polishing and Buffing Lathe

A polishing and buffing lathe, the design of which features variable speed by means of a special pulley, is being of-

Hammond Variable-Speed Polishing and Buffing Lathe

fered by Hammond Machinery Builders, Inc., 1617 Douglas Ave., Kalamazoo, Mich. The machine is said to introduce some radical changes in polishing equipment in accordance with the modern demand for variability of speed to meet varying requirements, and to make full use of wheels as diameter is decreased through wear.

Wide changes in speed are obtained through the use of a V-belt drive and

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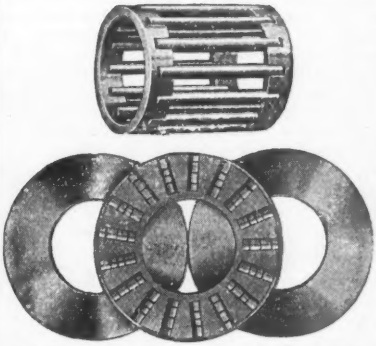

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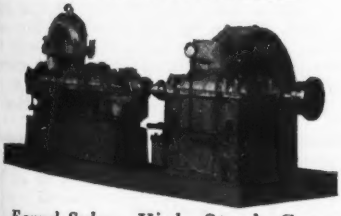


Farrel-Sykes High Speed Gear Unit designed to transmit 250 H. P. from an engine speed of 270 R. P. M. to a pump speed of 2900 R.P.M.

Ask for Bulletin No. 425

Speed reducing gear units for motors of 1800 R.P.M. or less are a common article of commerce. But gear units for very high speeds—3600 R.P.M. or more—are not made by the average gear manufacturer. They necessitate a higher grade of technique, both in design and manufacture.

Anticipating the need for reliable units for very high speed and speed increasing work, we have developed their standardization and continuous manufacture to a point which has enabled users to broaden the field of application of their products.

Our engineers will be glad to cooperate with you to determine if the usefulness of your products may be similarly enhanced.

FARREL-BIRMINGHAM COMPANY, INC.
381 VULCAN ST., BUFFALO, N. Y.

a patented pulley which may be changed easily and rapidly. Any speed within a 50 per cent increase over the low-rated speed of the machine is available; for example, speeds ranging from 2,000 to 3,000 r.p.m., from 1,800 to 2,700 r.p.m., or from 1,500 to 2,250 r.p.m. Changes of as little as 25 revolutions are possible. By using a Hammond variable speed pulley on the drive motor as well as on the lathe spindle, the range of speed variation can be further increased; also by changing to another size pulley on the motor.

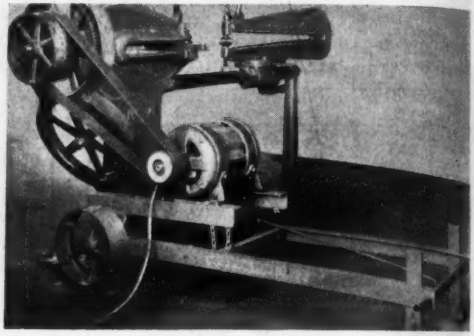
The standard machine of this type has a variable speed pulley on the spindle with a solid sheave on the motor. Changes in speed are obtained by expanding or contracting the special pulley to a Vernier scale letter and corresponding speed figure as indicated on a chart directly in front of the operator. One minute is said to be the average speed-change time.

This machine is said to have the same general features as the Hammond "Rite-Speed" line of machines. It is made in 3, 5, 7½ and 10 h.p. capacities; single or double spindle, with independent spindle control types.

Rockwood Portable Drive Truck

When a motor breaks down or needs repairs, or when it is desired to operate a single machine in a group without running the entire group, power can be applied to the single machine by using a motor on a portable truck as shown in the illustration. This truck was especially designed for the purpose by The Rockwood Manufacturing Company, 1900 English Ave., Indianapolis, Ind. With a motor anchored in place, the truck can be wheeled into position and the motor connected for operation usually not to exceed five minutes.

The saving in time over the time usually required to locate and get out a spare motor, hoist it onto a truck, move it to the required spot, drill holes in the floor for lagscrews or bolts or otherwise anchor the motor in position, cut a belt to suit, align the pulleys, and so on, is immediately apparent.



Rockwood Portable Drive Truck in use for applying power to a circling shear

The truck consists primarily of a standard Rockwood Drive incorporated as part of a sturdy, well-designed and well-built truck. Front and rear stops and stakes assure solid footing so that the truck can be locked in position and will not creep or crawl while the drive is in operation. Alignment of the motor and driven pulleys is quickly obtained, and the drive is then ready for operation. No cutting of belts is necessary. The motor base is pivoted, as in all standard Rockwood bases, so that a

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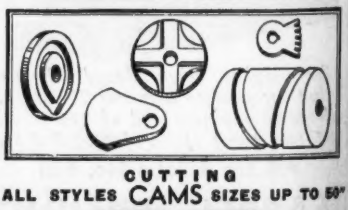

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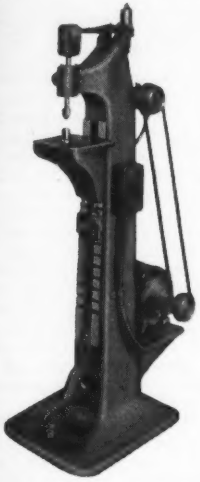
part of the weight of the motor is applied to automatically maintain the tension of the belt.

The truck is made in one size only, but practically any of the standard makes of electric motors or gas engines up to 500 pounds in weight can be accommodated.

Grant Rotary Vibrating Riveter

The illustration shows a rotary vibrating riveting machine that has been developed by The Grant Manfg. and Machine Co., 96 Silliman Ave., Bridgeport, Conn., especially for heading rivets cold from 3/32 in. to ⅝ in. diameter. This type of riveting machine is known as a vibratory hammer, due to the fact that



Grant Rotary Vibrating Riveter

the hammer spindle is caused to vibrate in a vertical direction and is positively rotated by means of a worm and gear.

The frame of the machine is of a single casting, and is designed to withstand the heavy vibrations of the riveting operation. The standard table has a flat top to accommodate fixtures, but in some cases a specially constructed table can be furnished to suit work where the standard table cannot be used.

The riveting peen is threaded for attaching to the hammer spindle, and is made from hexagon stock to allow for the use of a wrench. The bottom of the threaded hole in the peen is made flat

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Start Deltas off on a race with ordinary files. It is a good sporting proposition and an interesting one. But more than that the results will open up the way to new economies in your plant.

Select two workmen of equal ability. Give each an equal bar of metal, clamped in upright position in a vise. Let the race run for 60 seconds (approximately 55 strokes), catching the filings from each. Now for the decision! First compare the kind of filings. You will see that Delta filings are long chips (like those from a sharp lathe tool) instead of fine dust. Next, weigh the filings. You will find the Delta file has removed at least 25% more metal.

It is better, of course, to conduct an *all-day test*. For, the longer the competition, the more pronounced is the superiority of Delta Files.

Consider what a saving of 25% (or more) means in all your filing time. Surely you will decide to standardize on Deltas.

DELTA FILE WORKS

4837 James Street (Bridesburg)
Philadelphia, Pa.

so as to butt against the lower end of the hammer spindle, thus insuring a solid blow. The spindle is made from a chrome vanadium steel forging, heat treated to prevent crystallization.

The hammer spindle is rotated clockwise through a worm drive located inside the spindle arm. The worm wheel for rotating the hammer spindle is located between the upper and lower bearings with hardened and ground spacing washers. The hammer spindle bearings are of a special grade of bearing bronze, and are extra long. The worm shaft is driven by a V-belt connecting with the main shaft in the rear of the machine.

The front and rear rubber cushions are large and from the best grade of rubber, and the helve is made from a high grade of seasoned hickory. The main shaft has an eccentric bearing which gives the connecting rod a reciprocating motion. This connecting rod passes through a thrust block at the rear of the helve, thereby transmitting the reciprocating motion of the connecting rod from the eccentric to the rubber cushions, which in turn act on the thrust block and cause the helve to vibrate the hammer spindle.

The clutch is of the friction disc type, and a brake is provided to stop the hammer spindle in its uppermost position so that work can be inserted easily.

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9400 Copeland Ave. Detroit, Michigan

Carboloy General-Purpose Milling Cutter

Carboloy Company, Inc., 2485 E. Grand Blvd., Detroit, Mich., announces the development of a general purpose Carboloy face-milling cutter for universal use on cast iron, non-ferrous and non-metallic materials. The cutter, 5 inches in diameter, may be used over a wide range of cutting areas on these materials.

Heretofore the economical use of Carboloy milling cutters has been confined mainly to large, quantity-production jobs. This new general-purpose cutter has been developed for economical use on short-run, diversified milling jobs as well, it being possible to use the Carboloy standard cutter interchangeably on various milling jobs in the same manner as a high speed steel cutter.

In announcing this general-purpose cutter, the Carboloy Company points out that it is not intended to replace special Carboloy cutters on large, quantity-production jobs, as on this type of work the most efficient results are obtained

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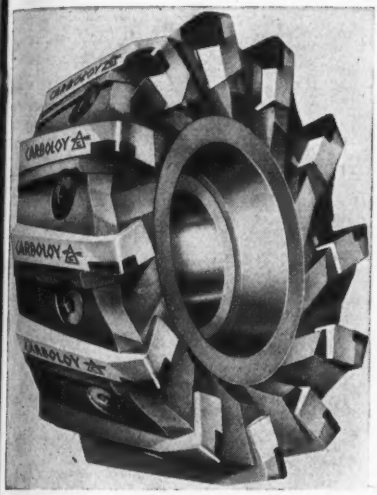
THE CHAS. L. JARVIS CO., GILDERSLEEVE, CONN.

with cutters especially designed for maximum performance.

The field of economical use of the general-purpose cutter is instead to be found on general milling work — short-run, highly diversified milling on many different kinds of materials. To make the general-purpose cutter practical for this type of work, modified designs are employed to produce economical results without the sensational increases in



Carboloy General-Purpose Milling Cutter for general use on diversified, short-run milling

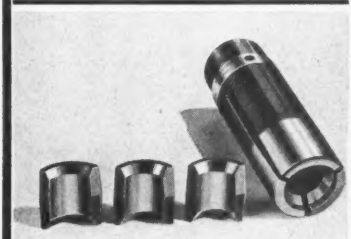
speeds, and so on, which are common to Carboloy milling on large, quantity-production jobs.

All of the benefits of cemented carbide milling on these large production jobs are, however, obtained with the general purpose cutter to an extent which permit a substantial saving on general milling work. Among these benefits are greater accuracy, improved finish, longer cutting life between grinds, the milling of hard materials, and the combining of rough and finish cuts.

Wicaco Water Cooled Wheel Head

Seven years ago engineers of The Wicaco Machine Corporation, Wayne Junction, Philadelphia, Pa., designed and built a water-cooled wheel head for use in their own shops to overcome difficulties that

SUTTON master feeder for automatics



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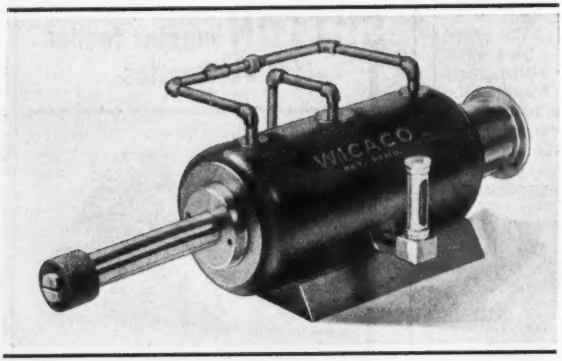

Wicaco Water Cooled Wheel Head

had been encountered with the type of wheel head then in use. The improvement effected lead the firm to equip all their grinders in the same manner and so many inquiries have been made regarding these heads that the heads have been placed on the market.

The outstanding feature of the head is the manner of using a water jacket, which makes it possible to operate the head continuously without appreciable rise in temperature. The jacket surrounds the oil chamber and bearings, and ordinary grinding coolant is pumped through it continuously. Thus the lubricant is maintained at the desired viscosity and chatter is precluded by the elimination, practically, of bearing wear.

The spindle is designed so as to rest completely within the bed of the cross slide, without overhang, thus eliminating the spring or torque which results in bell-mouthed holes. The precision ball bearings run in oil at all times. Heads are furnished with either quill or solid-type spindle in three sizes: small, medium, or large, with bases designed to fit all types and sizes of internal grinders. The maximum spindle speed will range from 10,000 r.p.m. on the large head, 15,000 to 18,000 on the medium size head, and 25,000 r.p.m. on the small head.

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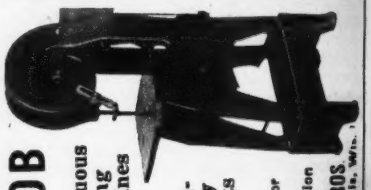

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Parkson Gear Testing Jigs

Gears can now be tested both quickly and accurately by the use of a gear test jig in which any and all errors in concentricity, center distance, tooth spacing, involute curve, and so on are determined at a single inspection. The jig, known as the Parkson Gear Testing Jig, is

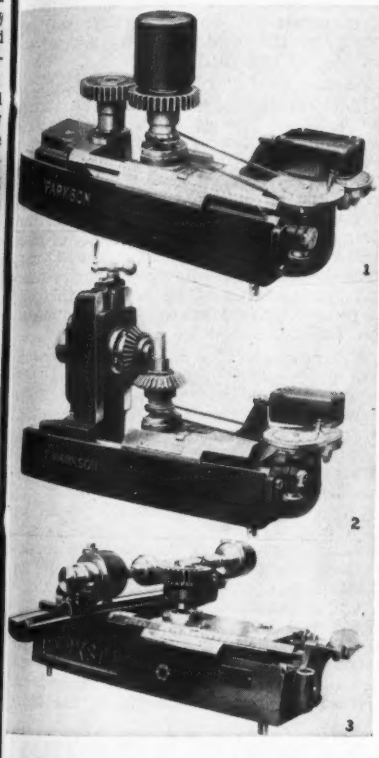

Fig. 1—Parkson Gear Test Jig for testing spur gears. Fig. 2—Jig for testing bevel gears at right angles. Fig. 3—Jig for testing worms and worm wheels.

being marketed in this country by George Scherr Company, 130 Lafayette St., New York, N. Y.

The Parkson Gear Test Jig is so designed that the test is practically a duplicate of operating conditions and the information obtained is generally conclusive because the operator can determine at once whether or not the

Good Gears are Necessary for Smooth Operation

If the product is to run smoothly over a long period of time, the gears must be good.

PERKINS Gears and Worms give users added accuracy, smoothness and dependability so necessary in successful machine performance. For smooth operation and absolute dependability, specify and order PERKINS Gears and Worms.

Without obligation we shall gladly quote you on your requirements. Send blue prints.

Perkins Machine & Gear Co.

151 Circuit Ave.
SPRINGFIELD, MASS.

gears are running silently and correctly. The jig is made in various types, for the different types of gears.

In using the jig, the gears are usually tested in pairs, although a templet gear can be used with a process gear if required. Both gears are mounted to revolve freely upon stationary arbors. One arbor is fixed in a carriage that is mounted on slideways on the bed; in use this carriage is clamped in position so that it is stationary during the test. The other arbor is carried by the floating carriage, which has a limited movement longitudinally on the bed and rolls on three steel balls, so that it moves under application of very little pressure.

A scale is attached to the adjustable carriage and a vernier to the floating carriage so that distance may be measured to 0.001 in. The scale and vernier are not supplied with jigs for bevel gears only, however, except on order. At any time the exact distances between the centers may be read from the scale and vernier, and variations of the center distance or movements of the floating carriage caused by defects in the teeth or by concentricity with the bore may be noted on the dial indicator carried at the end of the jig.

When a pair of gears are mounted, the adjustable carriage is moved to bring the teeth of the gears in close contact, in which position it is clamped to the bed. A spring plunger at the end of the bed is then regulated, by means of an adjusting screw, to give the desired pressure to the floating carriage, the spring plunger holding the teeth in close mesh. The center measurement may then be read on the scale and vernier and the gears may be rotated in order to judge the freedom and smoothness of the rolling action of the teeth.

As long as the floating carriage is not fixed, any variations in the gear teeth are indicated by movement of the carriage. The extent of the movement is indicated on the dial indicator. A regulating screw which acts opposite the plunger may now be brought into action sufficiently to show pressure on the plunger of the dial indicator, until the scale and vernier show the correct center distance. The gears can then be rotated in working position and defects in the cutting will be indicated on the dial.

The illustrations Fig. 1 and 2 show the jigs fitted with recording devices. The device traces, on a circular chart, a line corresponding to the movement of the floating carriage and thus records in permanent and graphic form the char-

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$79 Complete as shown Less Motor

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ATLAS PRESS CO.

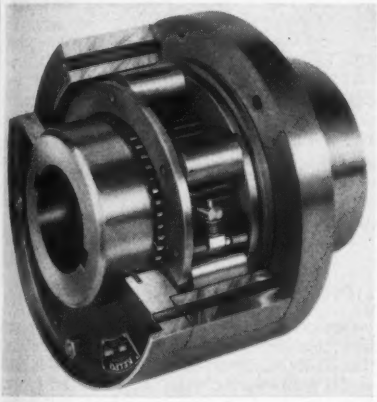
1846 N. Pitcher St. Kalamazoo, Mich.

acter of the gears under test. Each chart bears two lines; a true circle for purposes of comparison, and a circular line corresponding to the concentricity and regularity of the gear teeth. Actual errors are magnified about fifty times. The device may be fitted to all styles and sizes of these jigs.

Morse-Kelpo Clutch

The illustration shows the Morse-Kelpo Clutch, a product of the Morse Chain Company, Ithaca, N. Y., Division of Borg-Warner Corporation. The clutch is designed so that it is positively actuated in one direction; that is, it drives in one direction but is free-wheeling in the other. Operating with no back lash, it is ideal as a ratchet drive.

Used to connect two prime movers to a common load, either will pull the load



Morse-Kelpo Clutch

but neither can drive the other. This dual drive finds frequent application for two motors, or motor and turbine, driving force or induced draft fans, for auxiliary stand-by drive, and for booster drives for starting heavy machines such as printing presses, paper mill machines, and steel mill machinery.

The clutch is simple in design and of rugged construction. It is built of alloy steels, hardened and ground to close limits of accuracy. An exclusive feature of the Morse-Kelpo Clutch is its automatic compensation for wear.

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"Of course every one is telling you how good your Grinders are, but yet one more will do no harm.
"When we purchased the Type 'W' 3 HP Grinder from you in 1930 we also purchased two other makes of Grinders. We have put in two sets of bearings in the others but have given your grinder no repairs of any kind to date."
GEORGIA SCHOOL OF TECHNOLOGY
ATLANTA, GA.
This goes to prove DIRT CAN'T GET IN.

Hammond Machinery Builders
KALAMAZOO, MICHIGAN
Grinding, Polishing & Sawing Machinery

Geometric Combination Die Head

A combination hardened and ground die head that will take either circular or tangent chasers interchangeably now supplements the die head line of The Geometric Tool Co., 3 Valley St., New Haven, Conn. The result of many months of development, this ingenious head has been brought out to make the exacting

Geometric Combination Circular and Tangent Chaser Die Head

standards of Geometric die head construction available to those who favor the use of either circular or tangent chasers for long runs of identical threads, or where there is much unavoidable chaser breakage.

The chasers, holders and all, can be extracted from the head without its removal from the machine, ground and set, and replaced in the irreducible minimum of time required for these close exacting operations. The chasers can also be removed from the holders and accurately ground in a new Geometric fixture which is adapted for use on any universal surface grinding machine.

The circular chaser has a series of serrations for coarse adjustments, but any desired degree of adjustment between serrations is also provided. The tangent chaser has an equally minute adjustment. In resharpening, only enough metal need be ground off of either type of chaser to leave a clean cutting edge, which greatly lengthens its life. A chaser holder support made extremely rigid by heavy "T" slots and broad reinforcing wings, a post support for the circular chaser which is integral with the holder, and an improved four-point bearing for the tangent chaser are incorporated in the design.

Front plates that help to form the "T" slots which support the chaser holders are removable and replaceable in case of wear. This exclusive feature greatly lengthens the life of the tool. Broad locking surfaces that hold the chasers in cutting position, positive tripping and adjusting means, and simple provision for disassembling the head for cleaning are features of former design that have been retained in the new line. The combination principle (either tangent or circular chasers in one tool) is available in die heads of both rotary and stationary type, with the helix either in the chaser or in the holder.

Hilliard Over-Running Clutch

Designed to insure instant engagement and release, and of simple construction, the Hilliard Over-Running Clutch is said to fill a need that has long existed for an over-running or free-wheeling clutch for industrial use. The Hilliard Clutch is

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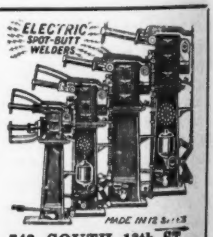
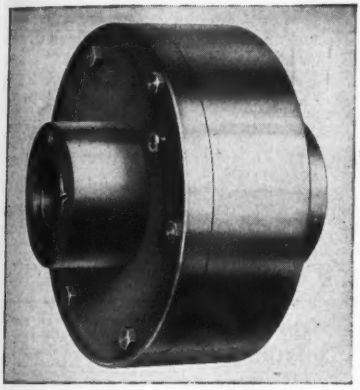


742 SOUTH 13th ST.
NEWARK, N. J.

a product of The Hilliard Corporation, Elmira, New York.

The clutch is designed on the principle that a roller running between an outer ring and an inner flat surface will drive between the outer and inner members when rotation is in one direction, and release or run free when rotation is reversed or when one member runs ahead of the other.

The simplicity of construction is apparent from a study of the illustrations. Parts are made of wear-resisting materials, properly treated, and bearing surfaces can be renewed without buying re-



Hilliard Over-Running Clutch

pair parts. The rollers are held in a bronze cage which is retained in its proper position when assembled by the small bracket shown on one face of the hub. The rollers bear only on every other flat surface and the bearing point is at one side of the center of the flat. The rollers also engage the ring pressed

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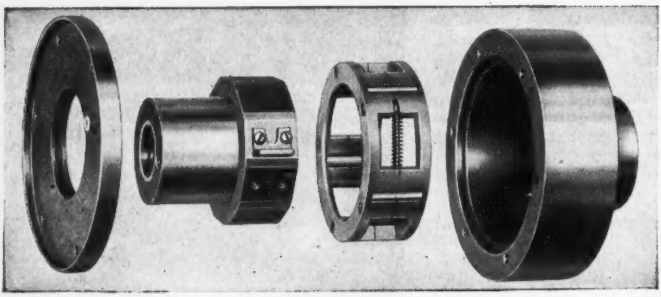

Hilliard Clutch Disassembled, Showing Parts

into the outer sleeve.

The inner member, the rollers, and the outer ring are made of oil-hardened, high carbon steel, ground to exact size. In continual operation, any wear that occurs takes place on the flat surfaces. These surfaces may be renewed four times without the necessity of new parts, simply by moving the cage carrying the rollers to new positions on the center hub. A felt seal prevents any leakage of lubricant.

The unit is sufficiently flexible so that it may be used either as a clutch or as a coupling to connect two shafts. The drive may be applied either through the outer sleeve or the inner hub on the shaft. A gear, sprocket, or pulley may be mounted on the sleeve. Direction of rotation may easily be reversed in the field.

This clutch is also furnished with a trip arrangement for use as automatic clutch where it is desired to start and stop a machine frequently without manual operation.

Rogers Automatic Knife Grinder With Time Clock Control

Samuel C. Rogers & Co., 203 Dutton Ave., Buffalo, N. Y., is now building an automatic knife grinding machine with a control so exact that it can be set to

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Balancing Ways
No Leveling Required
A simple and excellent device for balancing, straightening and trueing.

They are made in the following sizes:

Swing	Greatest Distance Between Standards	Capacity in Lbs.
20 in.	20 in.	1,000
40 in.	30 in.	2,000
60 in.	30 in.	2,000
72 in.	66 in.	5,000
96 in.	88 in.	10,000

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Mfd. By Anderson Bros. Mfg. Co.
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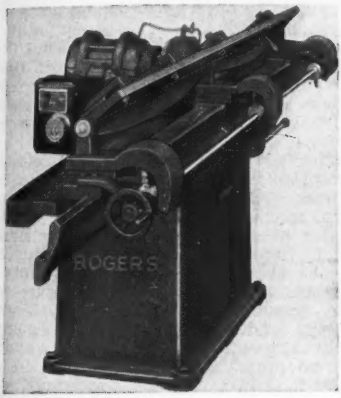
shut off the power and stop the operation at the end of any period from 1 minute to 45 minutes. This machine, which is designated as the Type "M", is a completely motorized and self-contained unit, wholly automatic, and built to the usual Rogers standards of workmanship. This machine will sharpen a knife in from 15 to 20 minutes.

The control consists in a timing device of special design, connected to the motor in such manner that it can be set to shut off the power and stop the machine at any pre-determined instant within a 45-minute period. The automatic operating mechanism includes the cross feed



Rogers Automatic Knife Grinder with Time Clock Control

and table traverse, as well as the wheel spindle. The motor is a General Electric ball bearing, 60-cycle with oil-immersed reversing and magnetic switches attached. The machine is so designed as to eliminate the use of cross belts, tight and loose pulleys, shifting levers, and other auxiliary transmission parts.

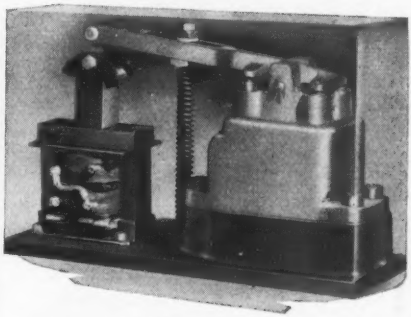
A feature of the machine is the wheel-reversing control. As the table reverses its travel at the end of each stroke, the wheel also quietly and instantly reverses. This change of wheel rotation has the effect of cutting in the correct direction; i.e., into the metal, at all times, thus producing smooth bevels without wire edges.

The base of the machine is of extra heavy cored type, enclosing the reversing switch, transmission shaft and pulley, gear box, water tank, and centrifugal pump. The bed and knife table are of

ROSS *Operating* VALVES

...here's the

Improved Solenoid Control Valve



Just push a button to control the improved Ross Solenoid Valve. You save time — it requires no effort — and it's more economical — no extra piping — less air waste.

Unit is of compact, rugged construction. Used either with A. C. or D. C. on all Ross Valves. Adaptable for single or double acting cylinder with pipe sizes from ⅜" to 1¼".

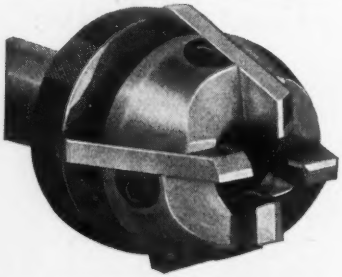
Write for Catalog illustrating Ross Operating Valves

ROSS OPERATING VALVE CO.
6488 EPWORTH BLVD.
DETROIT MICHIGAN

ample weight, designed and built to meet the stresses imposed. The knife table is fitted with the usual clamps, bolts, and so on, in addition to a dial for setting the knife at the proper level.

Mechanical, automatic, fast or slow cross feeds by positive acting worms and gears and ratchet are available. A hand wheel is provided for cross feeding if desired. The wheel is 8 in. diameter by 3½ in. special cup type, of the most suitable grade and grain. It is fitted onto a ball bearing motor shaft of radial and thrust type, eliminating all end play. The wheel can quickly and easily be swiveled to the proper angle for grinding hollow or concave bevels.

Standard equipment includes a round belt-driven centrifugal pump, a large capacity tank and double drain pans. It also includes the motor, reversing switch, magnetic switch, push button, electric control clock, one grinding wheel, water attachment, wheel dresser, and wrenches. The machine is made in four sizes; 38-in., 55-in., 76 in., and 90-inch.



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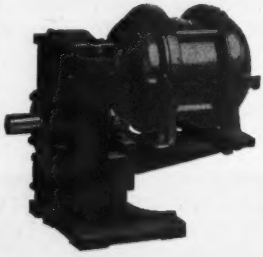
"Morflex" Coupling

The Morse Chain Company, Ithaca and Detroit, Division of Borg-Warner Corporation, announces a new and improved flexible coupling. The coupling is a companion to the Morse Standard Coupling and is called the Morflex. It uses an unusual and specially-developed rubber as the flexing medium, simple in design and based on the best modern practice.

The flexing member is a complete unit comprising four moulded non-cold-flow rubber trunnion blocks of special design spaced 90 degrees apart and set, under pressure, into a two-piece riveted steel housing. The rubber trunnion blocks are provided with steel cores or bushings also set under pressure into the blocks. The rubber is therefore always under pressure, which condition, it is known, prolongs its life qualities.

Two diametrically opposite blocks are bolted respectively to the armed steel driving and driven flanges which are mounted on the shafts to be connected. Thus all metal parts are rigid and all relative motion confined to the live non-cold-flow rubber.

There is no metal contact between the flanges, the only contact between the two shafts is through the flexible rubber bushings or blocks. There is no movement between rubber and metal, all



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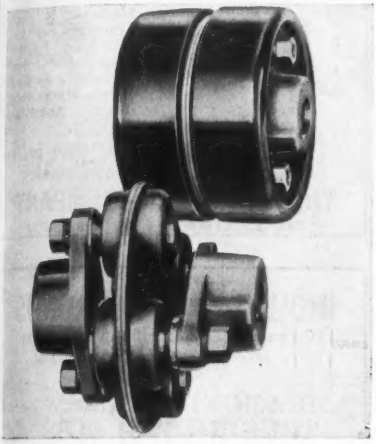
flexing being entirely within the rubber. Shocks and uneven impulses are absorbed and sudden reversals can take place without damage.



Morflex Coupling

The result is a rugged, noiseless coupling which has a maximum of flexibility. Accurate laboratory tests have shown that it will operate without power loss even with maximum misalignment. The Morflex Coupling needs no protection from atmospheric conditions, water, oil, dirt or grit, and requires no lubrication.

Parker-Kalon Cold Forged Thumb Screws

A cold-forged thumb screw made by an improved process in which the usual defects in thumb screws are eliminated has been placed on the market by the Parker-Kalon Corp., 200 Varick St., New York, N. Y. The thumb grips are nicely shaped and of even, well-balanced design, and are free of burrs and roughness; thus an excellent plated finish can be applied. The knurling provides a firm finger grip. The screws are roll-threaded to close limits, and are made for stock in a complete range of sizes from $\frac{1}{4}$ x $\frac{1}{2}$ in. 24 thd. to $\frac{3}{8}$ x 3 in. 16 thd. inclusive. Samples of the thumb screw will be supplied to any design engineer, production official, or purchasing agent upon request.

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As Designed by
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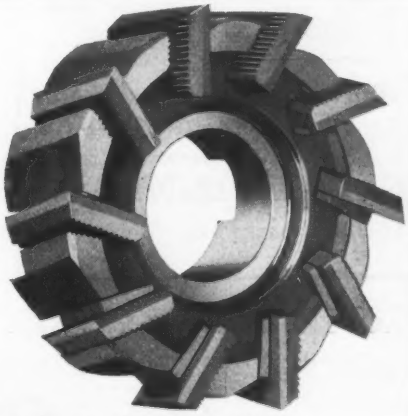

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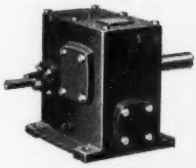

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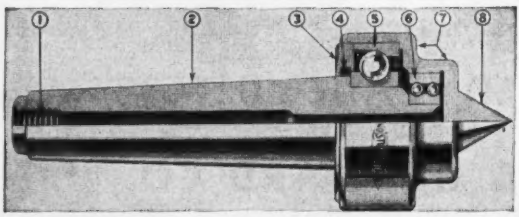

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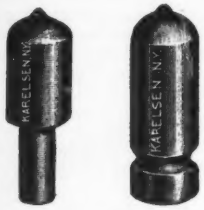
Diamond tools to meet the customer's specifications are now being furnished by E. Karelsen, Inc., 15 West 44th St., New York, N. Y., the only requirement being a rough drawing of the design



(Left)—Landis nib. (Right)—Norton nib.

required and data as to the material that is to be cut. Shaped diamond tools may be reset within a couple of days or so, the time required depending upon the amount of cutting to be done on the diamonds. Diamonds may be reset in dressers and returned the same day they are received. Dressers to fit such machines as the Norton, Heald and Landis grinding machines are kept in stock and can be supplied immediately upon order.

A bulletin showing some of the wheel dressers and shaped diamond tools made by this firm can be had upon request.

The Wrigraph Draft Block

The Wrigraph Draft Block, a recent development of L. G. Wright of Cleveland, is being marketed through Fletcher F. Milligan Company, 4632 Prospect Avenue, Cleveland, Ohio.

The illustration shows a Junior machine which was developed to meet the need of a low-priced unit that can be carried in a brief case for convenient use in the field, on the train, and in the office and home. It is complete in every detail and consists of a board and parallel device with drawing attachment in a single compact unit. The board is made of 3/16 in. Masonite and is equipped with clips which will hold either a single sheet or a pad of letter size paper. No thumb tacks are required. The parallel device is made of heavy nickel plated arms, connector and wrist plates, all accurately reamed and assembled with Tobin bronze bearings.

Either of two drawing attachments is provided. One is a novel combination

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Standard Bottom

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Capacity—from smallest to 3" taps. Free Floating Tap Collets insure true-tapped holes. Also furnished with collets for Morse Taper and straight shank drills.
Morse Taper shanks are standard. Special shanks are furnished for all makes of tapping machines, reversible tappers, air and electric tools and hand screw machines.
Unequaled for tapping, reaming, deep-hole drilling, stud and nut setting.

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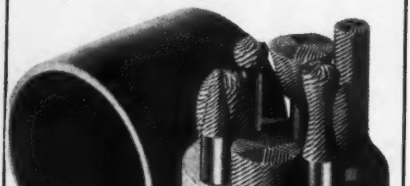

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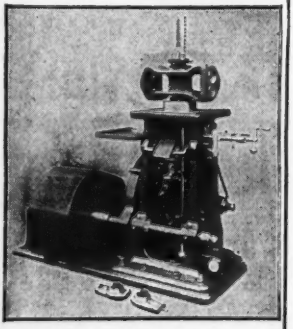

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Straight or taper keyways from 3/32" to 5" wide and up to 60" long in either straight or taper bores can be quickly cut on the GIANT Keyseater. Set up is fast and accurate . . . no bolts or clamps necessary. Work is held and aligned by its bore. Feed is automatic with accurate depth gauge. Cut automatically stops at depth set.

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of the 30-60 and 45 degree triangles into one. With it, angles of 15, 30, 45, 60 and 90 degrees can be accurately drawn and other angles can be approximated. The right angle sides of the device are graduated to ⅛ or 1/10 inch and provide ready drawing edges for horizontal and vertical lines without shifting position. The other drawing attachment consists of a protractor and a graduated straight edge which can be set by degrees to any angle required. It is particularly suited to surveying and aerial navigation.

Wrigraph Draft Block

With the machine and a pencil compass, even a novice can make very attractive and accurately dimensioned drawings. Each machine is carefully checked and calibrated to a master parallel-ruled plate and its accuracy and workmanship is fully guaranteed.

Stockton Profile Gage

Contours, curves, or angles can be duplicated and checked for accuracy by the use of the Stockton Profile Gage, product of the Stockton Profile Gage

Ask for Catalog B

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for

THE DRILL PRESS

NATIONAL MACHINE TOOL CO.
2271 Spring Grove Ave.
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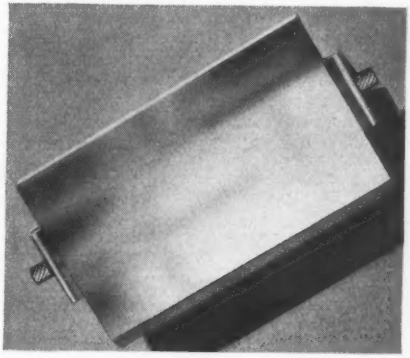
Corporation, 165 Jackson St., Lowell, Mass. The gage combines the features of simplicity, accuracy, and speed; there are no intricate parts to get out of order and although it can be used for very fine work, it is said to remain unchanged by ordinary use, vibration, and temperature changes.

The gage is made of a series of slotted laminations of uniform size and material, all of which are held in place by a flat bar which passes through the laminations and is held in place by tension nuts and clams. This construction is varied slightly in some special models. By releasing the side pressure of the tension nuts on the laminations, it is possible to jog the gage against the object to be measured and thus cause the laminations to adjust themselves to the contour of the object. By using the "profiler" that is provided with each gage it is possible to fit the laminations snugly to the contour. When the laminations have been adjusted to the profile, the tension nuts are tightened, clamping the laminations firmly in the desired position. The laminations are very fine, ranging in thickness from 0.032 inch down to 0.010 inch.

An important feature is the fact that the gage not only reproduces the profile desired, but the reverse as well. Once the laminations have been set, the gage



Stockton Profile Gage

may be placed flat on any surface so that the profile may be outlined.

The gage is made in a wide variety of styles and sizes, and special gages can be furnished on short notice. Additional

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laminations can be furnished for any standard or special gage, making it unnecessary to order an entirely new gage

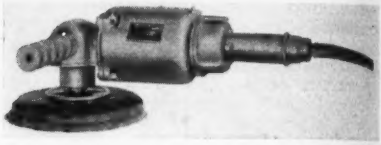
Showing how the laminations can be adjusted to duplicate a curved or angular profile.

in cases where an accident has damaged some of the laminations. Nuts and clamps can be replaced, as well.

Buckeye High Frequency Electric Portable Tool

The illustration shows a high frequency electric portable tool that has been placed on the market by The Buckeye Portable Tool Co., Dayton, Ohio. The tool as shown is equipped for rubbing down and polishing lacquer, although this tool can be supplied equipped with abrasive discs or cup emery wheels for sanding or grinding.

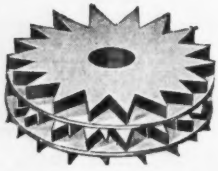
The specifications for the tool illustrated are as follows: 2 phase, 180-cycle motor, 110 or 225 volts; speed, 1800 r.p.m.; capacity, 8 to 9-in. disc with rubbing pad or lamb's wool; spindle, ⅝-in. 11 thds.; overall length, 16¼ in.; weight, 10½ lb. net. When equipped for sanding, the tool is speeded to 4700 r.p.m.



Buckeye High Frequency Electric Portable Tool

The tool is powered by an especially designed and constructed Hercules high

HOW TO DRESS GRINDING WHEELS



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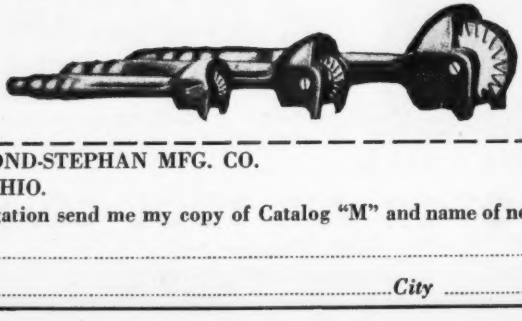
Send in the coupon for your copy of our Catalog "M" describing our complete line of grinding wheel dressers and cutters.



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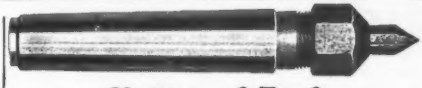

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HOBART BROTHERS

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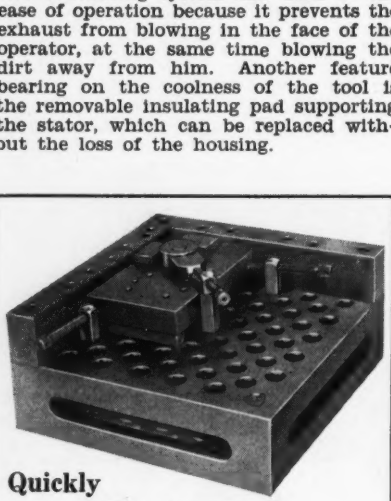
frequency motor which tests have shown to be exceptionally cool running. As the handles are thoroughly insulated from the body, it is not necessary to wear asbestos gloves when operating. An effective ventilating system also adds to the ease of operation because it prevents the exhaust from blowing in the face of the operator, at the same time blowing the dirt away from him. Another feature bearing on the coolness of the tool is the removable insulating pad supporting the stator, which can be replaced without the loss of the housing.



Quickly
Drill Accurately
Spaced Holes

Pat. No. 1954708

With the Universal Drilling plate, holes can be drilled and reamed by shifting the Master disc and using the proper gage blocks to give the required dimensions of holes to be drilled. Savings in time are amazing. Set up is simple, yet accurate. Costly equipment usually necessary for precision work is eliminated. Get the details.

Write For Circular

NATIONAL TOOL & MACHINE CO.
41 So. Water St. Rochester, N. Y.

Numberall Platform Numbering Machine

Brass tool checks, machine number plates, and all other similar small checks or plates can easily and quickly be stamped with letters or figures by using the platform numbering machine shown in the illustration. This is a hand-operated machine, and is a product of

Numberall Numbering Stand

the Numberall Stamp & Tool Co., Huguenot Park, Staten Island, N. Y.

The platform is 4x4 inches in size, and is equipped with flanges so that it can be bolted in place on a bench if necessary. The "stamp" slides vertically in a substantial bearing, and carries either 3, 4, 5, or 6 wheels, bearing either

Counterbores and Countersinks, Counterbore Sets, Spotfacers, Coredrills, Reamers, Hollow Mills, Full Floating Holders, Facing Heads, Form Cutters, Boring Bars, Boring Heads, Adjustable Extension Holders, Multi Diameter Tools.

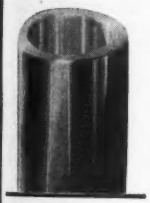
Catalog on Request: Representatives in All Principal Cities.

THE GAIRING TOOL COMPANY
DETROIT, MICHIGAN

FREE
TO WELDING USERS

Valuable booklet containing complete information on tested and approved types of arc welding accessories and supplies including head and face shields, welding lens,—electrode holders,—cable and attachments,—protective clothing such as aprons, gauntlets and leggings —all varieties of welding rods for mild steel, stainless steel, aluminum, manganese steel, cast iron, light gauge steel and hard surfacing. A handy booklet for those in charge of welding. Write for your copy of Bulletin 3304 today.

THE LINCOLN ELECTRIC CO.
DEPT. M-2, CLEVELAND, OHIO
Largest Manufacturers of Arc Welding Equipment in the World



Get Them Now...

645 stock sizes of Buckeye Bronze Bushings are listed with complete dimensions and prices in the new stock list "G". Write for this data as well as the New Electric Motor Bearing list. These folders will be sent without obligation.

Buckeye Brass & Mfg. Co.
6410 Hawthorne Ave., Cleveland, Ohio

Warehouse Distributors

R. R. STREET & CO., INC.
561 W. Monroe St. Chicago, Ill.

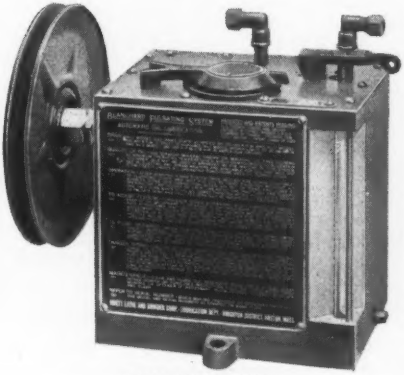
ATLAS BRASS FOUNDRY, INC.
1901 Santa Fe Ave. Los Angeles, Cal.

K-B DISTRIBUTING CO.
562 W. 52nd St. New York, N. Y.

CUTTER, WOOD & SANDERSON CO.
222 Third St. Cambridge, Mass.

BLANCHARD PULSOLATOR

AUTOMATIC OIL LUBRICATION SYSTEM FOR INDUSTRIAL MACHINERY



PUMPING UNIT

AUTOMATIC

Starts And Stops With The Machine
Feeds Bearings At Determined Intervals
Individually Measures Oil For Each Bearing

RELIABLE

Oil Feed Always Visible At The Bearings
Flushing Lever Constantly Shows "All Is Well"
Fresh Oil Regularly Applied to Bearings In Motion

ECONOMICAL

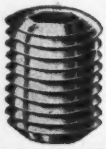
One Pumping Unit Can Supply 100 Bearings
Oil Measured As Low As One Drop An Hour
Single Loop Circulating Line Requires Minimum Piping

Write for Bulletin B-5.

RIVETT LATHE AND GRINDER CORP.
Faneuil, Brighton, Mass., U. S. A.

figures or letters, as desired. The stamp is held in position by a spring, and when in use, the stamp is pressed down by hand until it rests on the plate or check and then is struck a light hammer blow, making the desired impression in the material. The stamp holding arm works on a hinge and can be lifted to facilitate changing the numbers.

Numberall stamps are engraved by the latest Pantograph engraving method, producing sharp and clear characters. The platform is equipped with a graduated adjustable guide and setscrew to enable the operator to locate the plates or tags with speed and precision. The stamp can be removed from the holder, when required, for use as a hand stamp for stamping machines and other large objects. Figures or letters can be supplied from 1/16 in. to ¼ in. in size.



SAVE

That WRENCH COST

Manufacturers who furnish wrenches with their equipment can make a decided saving by adopting

BRIGHTON HOLLOW SCREWS

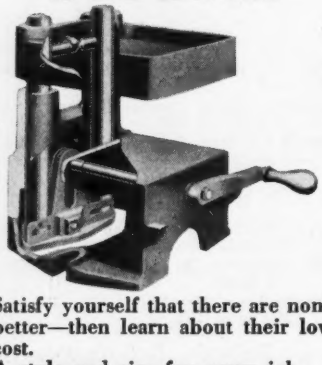
Write for Prices

The Brighton Screw & Mfg. Co.

1450 Harrison Ave. Cincinnati, O.

ESCO

Drill Fixtures Are Worthy of Your Attention



Satisfy yourself that there are none better—then learn about their low cost.

A style and size for every job.

Write for Circular

ESCO ENGINEERING SERVICE CO

1301 Summit St., Toledo, Ohio

DISSTON INSERTED-TOOTH METAL CUTTING SAWS; THEIR SELECTION AND CARE: This 12-page booklet, issued by Henry Disston & Sons, Inc., 421 Tacony, Philadelphia, Pa., tells how to select the best type of saw for the job in hand, the number of teeth the saw should have for different kinds of materials, when to use inserted tooth or solid saws, how to sharpen metal saws, and what to do to obtain the best results in operating.

The text is illustrated with drawings and photographs, and tables are included giving data as to the various types of cut-off machines in general use, sizes of saws that can be accommodated, sizes of stock that can be cut, horsepower, and so on.

A copy of the booklet will be sent to any mechanical executive who will address the firm as above.

"DIAMONDS FOR INDUSTRIAL PURPOSES." Those who are concerned with the use of diamonds for wheel-dressing, metal boring, or similar purposes will be interested in this book. Compiled by a firm who for generations has been engaged in the diamond trade, the book comprises a complete, but concise, treatise on the history, composition, distinctive features, classifications and origin of same, uses of the various kinds, manner of grading, and modern uses to which the diamond has been put. The book is published by Anton Smit & Co. London and Amsterdam, but it is available in this country through Selma Mercantile Corporation, 24 State St., New York, N. Y. Copies will be supplied to mechanical executives upon request.

"ALWAYS BLOWING BUBBLES" is the title of a four-page folder that describes in detail the advantages of using Johnson Universal Bronze Bars. Users of either solid or cored bronze bars or bronze bushings will find this data interesting. A table of 185 sizes of cored bars, showing the inside and outside dimensions and weight for each size of bar, occupies the fourth page of the folder. Copies free upon request.

Did You Know That---

A parts washing machine is now available that will receive a tote-box of parts at one end, wash and dry the parts, clean the tote-box separately, and deliver the clean box full of clean parts at the other end? See page 21.

Holes are now being tapped in steel at speeds up to 3,000 r.p.m.? See page 60.

Metal parts or surfaces can be made rust-resistant by washing with a new chemical solution? See page 32.

Internal surfaces are now being ground by the centerless method? See page 56.

Difficult drawing, threading, broaching, or other machining problems may be solved by the use of an inexpensive lubricant? See page 70.

You can reduce the cost of reaming holes by using an expansion reamer? See page 37.

You can make a scribing tool which will always find the center of the work regardless of diameter? See page 44.

Skin troubles caused by cutting oils can easily be prevented? See page 47.

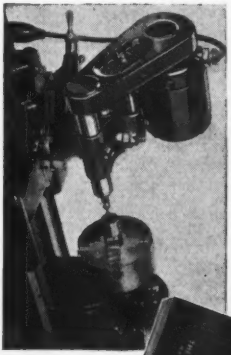
A book which describes "light-wave" equipment and tells how it is used to obtain accuracy within 0.00001 can be had for the asking? See page 62.

Savings in time of as much as 40 per cent are frequently effected by the use of simple assembling fixtures? See page 11.

That you can get free booklets which will tell you all you want to know about the best way to select and use metal-cutting band saws, inserted-tooth metal cutting saws, and other tools? See page 5.

How diamonds are classified and selected for various purposes of beauty or utility? See page 90.

Precision Grinding in Theory and in Fact!



The booklet illustrated gives you the basic theory of precision grinding. The Dumore No. 4 Grinder illustrated makes precision grinding a reality. . . The entire line of Dumore Grinders is specially designed for both internal and external grinding. They range in size from 1/64 to 3/4 H. P., speeds up to 40,000 R. P. M. and at prices from $17.50 to $240.00. Write for the booklet and details.

THE DUMORE COMPANY, 28 Sixteenth St., Racine, Wis.

DUMORE GRINDERS

For Your Catalog Library

Check any of these useful publications that you want, write your name, firm name, title, and address on the margin, then tear out the page and send to Modern Machine Shop, 128 Opera Place, Cincinnati, Ohio. They will be forwarded to you promptly without cost or obligation. Please restrict your list to not more than five.

Cutanit, the Master Cutting Alloy: A booklet describing a titanium carbide hard metal for machining steel and all other metals, giving speed, feed and depth of cut on a variety of jobs, and including directions for brazing and grinding, will be sent upon application to American Cutting Alloys, Inc., 347 Madison Ave., New York, N. Y.

Ames Dial Gages: Dial gages, gage heads, cylinder gages, dial thickness gages, dial micrometers and special gages and attachments made by the B. C. Ames Company, Waltham, Mass., are described and illustrated in Catalog 50. Write for copy.

Scrape by Power: Bearing surfaces can be scraped with a power scraper that is quicker and easier than the antique hand method. Write for information to Anderson Bros. Mfg. Co., 1926 Kishwaukee St., Rockford, Ill.

Stop Tap Breakage: A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by The Apex Machine & Tool Co., 200 Davis Avenue, Dayton, Ohio. Sent free upon request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

A New Deal In Hacksaw Blades: "Blue End" Hacksaw Blades reduce costs by cutting faster and lasting longer. Write for data and prices to E. C. Atkins & Co., 402 S. Illinois St., Indianapolis, Ind.

"Atlas" Bench Lathe: A 9-in. screw cutting, self-contained, motor-driven bench lathe is now being built by Atlas Press Co., Kalamazoo, Mich. Write for circular.

Arbor Presses in 64 types and styles are described and illustrated in a catalog that can be had by writing Edwin E. Bartlett Co., Nashua, N. H.

"Ground-From-The-Solid" Taps: Bath taps are hardened in the solid, then the teeth are generated by grinding, producing absolutely accurate taps. Write for the "Ground Thread Handbook", free. John Bath & Co., Inc., Worcester, Mass.

Drop Forged Steel Die Sets: The economy and other advantages of drop forged steel die sets, which are now being made by E. A. Baumbach Manfg. Co., 1806 South Kilbourn Avenue, Chicago, Ill., are explained in a folder that can be had by addressing this firm.

Brighton Safety Set Screws provide an important factor of safety. No heads to project. The Brighton Screw & Mfg. Co., 1450 Harrison Ave., Cincinnati, Ohio.

Fine Tools of All Kinds are described and illustrated in a new catalog that has been issued by Brown & Sharpe Mfg. Co., Providence, R. I. Copy free.

Buckeye Pneumatic and Electric Tools—drills, grinders, nutsetters, screwdrivers, polishers, buffers and other tools are fully described in the "Hercules" Catalog. Write for copy to The Buckeye Portable Tool Co., Dayton, Ohio.

645 Stock Sizes of Bronze Bushings are listed with dimensions and prices in the Buckeye Stock List "G". Write for it. Buckeye Brass & Mfg. Co., 6410 Hawthorne Ave., Cleveland, Ohio.

Bushings and Bearings: 500 sizes of finished bronze bushings that are available immediately are shown in a catalog that can be had by writing to The Bunting Brass & Bronze Co., Toledo, Ohio.

Carboloy Cost-Saving Tools: This booklet, issued by Carboloy Company, Inc., 2485 E. Grand Blvd., Detroit, Michigan, shows a variety of types and designs of Carboloy tools which will increase production and reduce machining costs. Copy free upon request.

Cut Die Costs: A booklet that describes and illustrates a new type of hand grinder for use with a variety of small wheels for finishing fine work is described in a booklet that has been issued by Chicago Wheel & Mfg. Co., 110 S. Aberdeen St., Chicago, Ill. Copy free upon request.

"Hypro" Planers: The most modern engineering practice is incorporated in the design of Cincinnati "Hypro" Planers, made by the Cincinnati Planer Co., Oakley, Cincinnati, Ohio. Write for catalog.

"Circle R" Saws for cutting metal, made in both carbon and high speed steels, from ¼ in. to 10 in. in diameter, are now available. Write to Circular Tool Co., Inc., 767 Allens Ave., Providence, R. I., for catalog.

Balance Your Parts the Micro-Poise Way: Vibration can be removed from flywheels, fans, wheels, and other rotating parts by eliminating dynamic unbalance. Ask Commerce Pattern Foundry & Machine Co., 2213 Grand River Ave., Detroit, Michigan, for full information.

Centerless Grinding: A high-speed service at low cost. If you have cylindrical parts to be ground, send blue-prints for estimates to Commercial Centerless Grinding Co., 6538 Carnegie Ave., Cleveland, Ohio.

Motorize Your Cone Pulley Lathes: An attachment that can be applied to your lathe with four bolts makes it possible to motorize and modernize your lathes. Write for information to Cullman Wheel Co., 1336 Altgeld St., Chicago, Ill.

Die Makers' Supplies: A complete line of die sets, leader pins, bushings, and other die makers' supplies are described in a book that is issued by the Danly Machine Specialties, Inc., 2104 South 52nd Avenue, Chicago, Ill. Sent free upon request.

David Keyseaters: The newest methods of keyseating are discussed in a bulletin that also describes and illustrates the keyseating machines made by the Davis Keyseater Co., 250 Mill St., Rochester, N. Y. Copy free upon request.

Delta "Hand Milling Tools": The features that entitle Delta files to be called "hand milling tools" are discussed in a booklet that can be had by addressing The Delta File Works, 4837 James St., (Bridesburg), Philadelphia, Pa.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Demond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Alloy Tool Steels for Cutting Tools, for Dies, or for Parts Manufacture: Write to Detroit Alloy Steel Co., Foot of Iron St., Detroit, Michigan, for a free set of specialized literature, Series F, describing the uses and advantages of modern alloy tool steels.

Assemble by Power: A power screwdriver that will set and screw in machine screws at a rate of from 400 to 500 screws an hour is described in a folder than can be had by writing to the Detroit Power Screwdriver Co., 5365 Rohns St., Detroit, Mich.

Steel Spacing Washers: Milling jobs can be set up quicker by using standard spacing washers, made by Detroit Stamping Co., 1345 West Fort Street, Detroit, Michigan. Write for information.

Cut Your Sawing Costs with Disston Inserted-Tooth Metal Saws. Manual explaining features of construction, advantages of design and outstanding results obtained can be had by writing to Henry Disston & Sons, Inc., 421 Tacony, Philadelphia, Pa.

Special Quills for Precision Grinding, made by The Dumore Company, 28 Sixteenth St., Racine, Wis., are described and illustrated in a booklet that can be had by addressing the firm mentioned.

Edgemont Expanding Clutches for countershafts and similar applications are described in full in Catalog H, issued by The Edgemont Machine Co., Inc., Dayton, Ohio. Copy free.

"Speed" Spot Welders for welding metals from 0.0005 in. to ⅝ in. thick are described in a catalog that can be had by addressing Eisler Electric Corp., 761 South 13th St., Newark, N. J.

"The Dragon" is the name of a publication that is devoted to bearings and bearing problems. It will be sent without charge to any mechanical executive who will address his request to The Fafnir Bearing Company, New Britain, Conn., using his firm letterhead.

Accurately-Cut Gears of all kinds, types, and sizes can be had on short notice from Farrel-Birmingham Co., Inc., 381 Vulcan St., Buffalo, N. Y. Catalogs and engineering data on request, or submit your specifications for quotations.

Precision Measuring Instruments: The latest types and models of dial indicators, thread lead test gages, pitch gages, dial comparators, and other precision gages made by Federal Products Corporation, Providence, R. I., are described in a booklet that will be sent free upon application.

Performance Data On Swiss Jig Borers: This 36-page pamphlet shows various types of jobs from a power shovel turntable jig to a television disc, drilled and bored on Societe Genevoise High Speed Precision Borers, giving data as to size of holes, accuracy and time savings. Free upon request to The R. Y. Ferner Co., 1008 K Street, N. W., Washington, D. C.

Ford Rotary Files. M. A. Ford Mfg. Co., Davenport, Iowa, is issuing a catalog showing, in addition to the complete line of Ford Rotary Files, illustrations of rotary files in use on various kinds of jobs. Write for copy.

Drilling Machines of modern design—single spindle, gang high speed, and radial types—are described and illustrated in a catalog that will be sent upon request. Address The Fosdick Machine Tool Co., Cincinnati, Ohio.

Tool Grinding Costs can be cut by using the "Economy" face milling cutter. Write to J. E. Freyman & Sons, 3627 Keswick Road, Baltimore, Md., for information.

Stampings of any kind or size can be obtained from Gerding Brothers, 5 East Third Street, Cincinnati, Ohio. Write for particulars.

Special Genesee Production Tools: A bulletin issued by Genesee Manufacturing Co., Inc., Rochester, N. Y., describes and illustrates some of the special production tools made by this company. Copy free upon request.

Die Head for Circular or Tangent Chasers: This new tool, made by the Geometric Tool Co., New Haven, Conn., is described in a bulletin that has been put out by this firm. Ask for copy.

Tool Chests: Fine tools should be protected against damage or theft, and the best way is to keep them in a fine tool chest. Write "Gerstner Tool Chests", 1227 Columbia St., Dayton, Ohio, for catalog of fine chests.

Constant-Level Oilers will keep your electric motors properly oiled with a minimum of care. Write for details to Gits Bros. Mfg. Co., 1847 S. Kilbourn Ave., Chicago, Ill.

"Tools That Go and Go" is the title of a catalog describing and illustrating the milling cutters, inserted tooth cutters, railroad work cutters, expansion reamers and mills, thread hobs, and other cutters made by Goddard & Goddard Company, 12280 Burt Road, Detroit, Mich.

3-Speed Riveters designed for high production and hard service over a long period of time are fully described in a catalog that will be sent upon request to Grant Mfg. & Machine Co., 96 Silliman Ave., Bridgeport, Conn.

Cut Your Die Costs by using a continuous filing machine. Write to Grob Brothers, West Allis, Wis., for information and prices.

Swiss Files: The complete line of Grobet Swiss Files for use in die work or other fine work, is described and illustrated in a catalog that can be had by addressing the Grobet File Coporation of America, 3 Park Place, New York, N. Y.

Ball and Roller Bearings, either journal or thrust for all purposes and all sizes, are described and illustrated in catalog No. 9 which has been issued by The Gwilliam Company, 360 Furman Street, Brooklyn, N. Y. Copy free upon request.

Variable Speed Grinding and Polishing Machines: will produce better work at lower costs. Write for catalog of polishing and grinding equipment to Hammond Machinery Builders, 1615 Douglas Ave., Kalamazoo, Mich.

Drafting Tables and other drafting room furniture of steel and wood and of the most recent design are described in a 60-page catalog that has been published by the Hamilton Manufacturing Co., Two Rivers, Wis. Copy free to any mechanical executive.

Dermatitis—Infection from cutting oils—can be prevented. Write to Huntington Laboratories, Inc., Huntington, Ind., for complete information.

"Haskins" High Speed Tappers will tap your holes at highest speed, with tap breakage practically eliminated. Tapping speeds up to 3,000 r.p.m. Write R. G. Haskins Co., 4667 West Fulton St., Chicago, Ill.

Precision Bench Lathe Work can only be done on finely-built, accurate machines. The complete line of Hjorth Precision Bench Lathes is described and illustrated in a catalog that has been issued by Hjorth Lathe & Tool Company, 60 State Street, Boston, Mass. Copy free upon request.

Every Machine Shop Should Have a Welding Outfit: Welding is the most modern of metal working operations. An Arc Welder's Manual, containing information on the use of the arc welder, can be had free by writing to Hobart Brothers, Box ME-103, Troy, Ohio.

Pyrometers: Inexpensive portable and stationary single unit and multi-circuit pyrometers are described in a catalog issued by Illinois Testing Laboratories, Inc., 146 West Austin Avenue, Chicago, Ill. Copy free upon request.

Oil and Waterproof Chucks: The J & H Electric Co., 202 Richmond Street, Providence, R. I., is now making a chuck that is oil and waterproof, and is designed to provide a maximum of holding surface with exceptionally strong and uniform pull throughout. Ask for complete information.

Solve Your Tapping Problems with a Jarvis Tapper. Tapping devices for every type of job. Write The Charles L. Jarvis Co., Gildersleeve, Conn., for information and prices.

Diamond Tools for dressing grinding wheels can be obtained from E. Karelsen, Inc., 15 West 44th St., New York, N. Y. Also dressers reset and resharpened. Write for information.

Cams—Any Style—Any Size—up to 50 inches can be had from Kux-Lohner Machine Co., 3147 Lexington St., Chicago, Ill. Write for data.

Threading Machinery: Complete catalogs of individual bulletins covering the pipe threading and cutting machines, bolt threading machines, or die heads made by Landis Machine Co., Waynesboro, Penna., may be had upon request from this firm. State size and type of machine or die head.

Weld Cast Iron: With 80 amperes D.C. welding current, solid, dense welds of greater tensile strength and ductility than the iron itself can be produced. Write to The Lincoln Electric Company, Dept. M-1, Cleveland, Ohio, for full information.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

L-R Flexible Coupfings are simple, resilient, reversible. Only three parts. Write Lovejoy Tool Works, 303 West Ohio St., Chicago, Ill., for information.

"Last Word" Indicators, built for accuracy, adaptability, and dependability are described in a circular that can be had by addressing H. A. Lowe Co., 1875 East 66th St., Cleveland, Ohio.

Magnolia Bronze Bar Stock, semi-finished inside and outside in S. A. E. specifications is now available. Write to Magnolia Metal Company, Elizabeth, N. J., for folder.

McCrosky Block Boring Bars: A new and improved method of accurately locating and locking the block in the bar provides any desired amount of float, with a new method of taking cutting thrust. Ask McCrosky Tool Coporation, Meadvile, Pa., for Bulletin 12-D.

Mendes Diamond Point Angle Tools for Wheel Dressing are described in Folder "M", issued by Mendes Cutting Factories, Inc., 105 West 40th St., New York, N. Y. Copy free upon request.

Time Study Watches, built for accuracy and service are described in Folder No. 3, issued by A.

R. & J. E. Meylan, 266 West 40th St., New York, N. Y. Ask for copy.

Key-way Cutting is a simple operation when the right tools are used. Write for catalog of modern keyway cutting machines to Mitts & Merrill, 1009 S. Water St., Saginaw, Mich.

Magic Chucks: Instantaneous change of tools without stopping the machine spindle can be accomplished by the use of Modern Magic Chucks, made by the Modern Tool Works, Rochester, N. Y. Write for descriptive booklet.

"Practical Machinist's Guide". A handy shop manual, containing tables of tapers, speeds and feeds, instruction for grinding twist drills, thread dimensions, tap drill sizes, and other useful information can be had by writing to Morse Twist Drill & Machine Co., Dept. 32, New Bedford, Mass.

Compound Spot-Facing Tool: A spot-facing tool containing retracing, serrated roughing cutters and fixed finishing cutters in the same tool will break up the scale easily and do accurate work. Write for bulletin to Mummert-Dixon Co., 120 Philadelphia St., Hanover, Penna.

Mill Keyseats with a Drill Press: A special attachment that can be applied to a drilling machine for milling keyways is now being made by National Machine Tool Co., 2271 Spring Grove Ave., Cincinnati, Ohio. Ask for circular.

Reduce Equipment Expense: Nicholson Expanding Mandrels will save on your equipment investment and will insure a mandrel for holes of every size from ½ in. to 7 in. Write for details to W. H. Nicholson & Co., 136 Oregon St., Wilkes-Barre, Pa.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

Stamp with Numberall: The complete set of figures or letters all combined in one tool, preventing loss of single letter or digits. Write for catalog. Numberall Stamp & Tool Co., Huguenot Park, Staten Island, N. Y.

Speed Reducers: Speed Reducers to obtain any desired reduction up to 24,000 to 1 are described and illustrated in Catalog 29 A, issued by The Ohio Gear Co., 1335 East 179th St., Cleveland, O. Copy free upon request.

Die Making Machines: How dies, templates, pages, etc., can be sawed out, filed, and lapped easily and accurately on Oliver die making machines, is fully described in a bulletin issued by the Oliver Instrument Company, 1430 Maumee Street, Adrian, Mich. Mailed upon request.

Automatic Polishing and Buffing Machine, designed by production specialists and built according to the latest principles of engineering, will polish work uniformly and economically. Write for information to The Packer Machine Co., Meriden, Conn.

17 Years of Research in Rust Proofing are incorporated in the information contained in a book on "Parkerizing", issued by Parker Rust-Proof Co., 2204 East Milwaukee Ave., Detroit, Mich. Ask for copy.

Good Gears of all kinds—spur, spiral, bevel, worm, hypoid—in fact any kind or type of gear desired, large or small, machined to an excellent finish and the highest degree of accuracy may be obtained from Perkins Machine & Gear Co., 151 Circuit Ave., Springfield, Mass. Write for estimates.

Reduce Grinding Costs: Let the Porter Machine Co., 3120 Forrer Ave., Cincinnati, Ohio, grind your straight, cylindrical, shoulder, and profile surface work by the centerless method at low cost. Send blue prints for quotations.

Production No. 601 Machine for sanding, surfacing, polishing, burring; leaves a straight line finish; eliminates hand labor. Write Production Machine Co., Greenfield, Mass., for illustrated folder.

Bench Lathe Mounting and Driving Equipment: Bulletin 120-A, issued by Rivett Lathe and Grinder Corporation, Brighton, Mass., contains complete descriptions and illustrations of modern and conventional countershaft, individual motor drive jack shaft, and speed box motor drive, also benches, cabinets, oil pans, etc. Copy free upon request.

Flat Wire to meet your specifications can be had from John A. Roebling's Sons Co., Trenton, N. J. Write for information.

Foot-Controlled Air-Valve: Air-operated equipment can now be controlled by valves that are operated by the foot, leaving the hands free to operate the machine. Write for information to the Ross Operating Valve Co., 6488 Epworth Blvd., Detroit, Michigan.

Rotor Air Tools: The latest types of air-operated hand tools for grinding, polishing, drilling, and other similar operations are described and illustrated in a 24-page book that can be had by writing The Rotor Air Tool Company, 5704 Carnegie Ave., Cleveland, Ohio.

Cut small gears, pinions, ratchets, automatically. An automatic hobbing machine for small work, with magazine feed, is described in Catalog WMI, issued by Geo. Scherr Co., 130 Lafayette St., New York, N. Y. Write for free copy.

"Diamonds for Industrial Purposes": An interesting treatise on the history, composition, features, and classifications of diamonds. Copy free to mechanical executives. Address Selma Mercantile Corporation, 24 State St., New York, N. Y.

Simonds Files: A useful book on files showing the various styles made, their uses, cross-section, and cuts, and containing a number of reference tables and other information useful in a machine shop can be had by addressing Advertising Dept., Simonds Saw & Steel Co., 470 Main Street, Fitchburg, Mass.

The Live Center you have been Looking For: The Sturdimatic Live Center has eight outstanding features; just what you have been looking for. Ask for bulletin and prices. Sturdimatic Tool Co., 5222 Third Ave., Detroit, Mich.

Sutton "Sur-Grip" Collets with Diamond Serrations are fully described in a folder that will be sent without charge upon application to Sutton Tool Company, 2842 W. Grand Blvd., Detroit, Mich.

"Midget" Five-in One Slide Rule is a combination of Mannheim, Polymetric, Log-Log, Binary, Add and Subtract Slide Rule. Is 4 in. diameter, gives equivalent of 12-in. rule. Write to Tavella Sales Co., 21 West Broadway, New York, N. Y., for catalog and prices.

Your Arbor Press Is a Keyway Cutter when it is equipped with Threadwell Keyway Cutting Tools. Simple, economical. Write for bulletin. Threadwell Tool Co., Greenfield, Mass.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopkins" Air-Operated Equipment. Published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

Steels for shafting, manufacturing, and all other purposes where cold finished steels are required can be had in a wide range of sizes, ready for use. Ask Union Drawn Steel Co., Massillon, Ohio, for name of nearest distributor.

Multiple Drilling With a Single-Spindle Drill: Methods by which multiple drilling may be done on a single-spindle drill, using multiple spindle drill heads, are discussed in a bulletin that is issued by The United States Drill Head Co., 1954 Riverside Drive, Cincinnati, Ohio.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, surface grinders, toolpost grinders, and bench and floor grinders is described in Catalog No. 33, published by The United States Electrical Tool Co., 2471 West Sixth Street, Cincinnati, Ohio. Copy free.

Universal Drill Bushings: Interchangeable Nitrided Drill Bushings, and Universal Tool Holder your production problems. Write for Data Sheets. Shanks for end mills and other tools will simplify. Universal Engineering Co., Frankenmuth, Michigan.

Roeing, Engraving, Filing, Grinding can be done on your milling machine, equipped with a Universal High Speed Milling Head. Ask Universal High Speed Tool Co., 647 West Washington, Chicago, Ill., to send one on trial or send descriptive folder.

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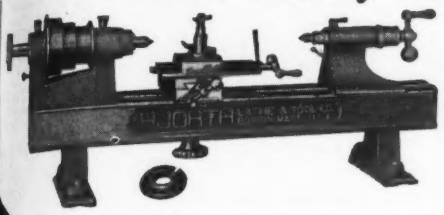

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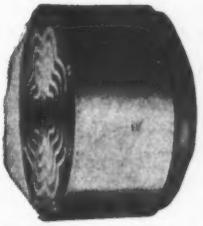

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Waltham Cylindrical Sub-Presses may be adjusted for wear and perfect alignment can be maintained. Booklet on Sub-Presses and Dies can be had by addressing Waltham Machine Works, Waltham, Mass.

Toolmakers' Tool Chests: The complete line of fine tool chests for toolmakers and machinists made by J. M. Waterston, 420 Woodward Ave., Detroit, Mich., is described in Catalog No. 25. Write for it.

Increase Life of Dies and Tools by using a new, patented compound for lubricating the sheets. A free sample can be had by any plant executive who will address Wayne Chemical Products Co., 9400 Copeland, Detroit, Michigan.

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Your Own Power Plant is contained in a Witte engine. Oil or gas. No expert operator needed Write Witte Engine Works, 1723 Oakland Ave. Kansas City, Mo., for catalog.

Feed Stock from Coils at High Speed: Bulleti MS, issued by Wittek Manfg. Co., 4305 W. 24th Place, Chicago, Ill., gives full details regarding the Wittek Automatic Roll Feed for Punch Presses. Copy free upon request.

"Toolmakers to American Industry"

(*Continued from page 38*)

sent and a representative of the Urbana Tool and Die Company followed it up with a visit. Upon being ushered into the superintendent's office, he was asked by the superintendent if he was the man who had pestered him with the wires. Of course, the reply was in the affirmative. Just then the superintendent was called out, and during his absence his secretary told the representative that he was likely to be thrown out of the window, as the superintendent was much annoyed with these telegrams. But to the representative's surprise, on the return of the superintendent he was told that a representative of the firm would accompany him to the Urbana Tool and Die plant that evening for an inspection of it and if it was approved, the electrical firm would be glad to favor them with their orders. The assistant approved the plant, and this electrical concern is still one of the good customers of the Urbana Tool and Die Company, although it has been 20 years since that first order was received.

Credit Due

The conveyor equipment described and illustrated in the article "Conveyors Expedite Production of Lycoming Motors", which appeared in the March issue of this magazine, was installed by the Mathews Conveyor Company, Ellwood City, Pa.

Monarch Announces New Grinder Catalog

The Monarch Machine Tool Company Sidney, Ohio, has announced a new two-color catalog which pictures and describes its new Precision Tool-Room Surface Grinder. This catalog is developed along modern lines, and incorporates a number of highly dramatized illustrations. It pictures several views of this machine, the automatic force feed lubrication feature, and a number of tests which illustrate the accuracy of this machine and the smoothness of the work it produces. A copy will be sent to any one interested.

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For operating single and double acting cylinders on equipment using air, steam, oil or water up to 350 lbs. pressure. No troublesome plugs, leather washers or packless stems to leak, but a flat disc regrinding type that holds tight over a long period. Write for circulars.

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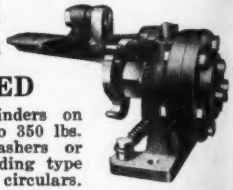

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